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THE GRANITES OF CARBON COUNTY, MONTANA: A DIVISION AND GLACIER FIELD OF THE SNOWY RANGE.

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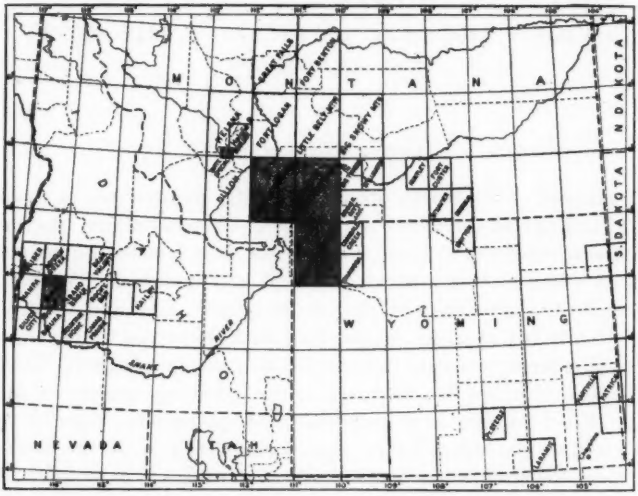
That part of the Rocky Mountain uplift, culminating in Granite Peak (12,824 feet), between the prairie of Carbon County, Montana, and the southern boundary of that State, has remained unmapped, and its more elevated parts unvisited and unnamed. Within an alpine area, at the head of the two Rosebuds, East and West, at a general altitude of about 10,000 feet, and above the timber line, a great number of summits tower 2,000 to 3,000 feet higher. Granite Peak, according to Mr. Gannett, is the crowning summit of Montana. From its mantle of perpetual snow gathers the névé of powerful active glaciers. Other remarkable glaciers, at the head of the West Rosebud, including Grasshopper Glacier, have their névé on two sides of Zimmer Mountain. Several glaciers descend in separate channels from one great névé field at the head of the same stream, and especially from the Sawtooth massif. The Broadwater branch of Clark's Fork, and its supreme head, has its source in a glacier nearby on the opposite side of the divide, and in another on the side of Mount Wilse. The Fishtail falls from a glacier on Mount Wood; the East Rosebud from another on the north side of Mount Dewey. Above the névé fields rear bare, untrodden summits of the peaks, named, too steep for mantles of snow.

Prospectors from the mining camp of Cooke, advancing a futile search for minerals near a score of years ago, above the timber line, to Goose Lake pass, and the base of Zimmer Mountain, gave some of these and a few other names to prominent topographical features

that came within their ken. Turned back from their quest at the snow fields and glaciers, and unrewarded by mineral discoveries, even the hardiest never forced the chasms or braved the desolate heights beyond. To these adventurous pioneers, a few of whom still linger about the now nearly deserted camp, the high mountains to the north still remain *terra incognita* and a mystery as for nearly a quarter of a century past. So, too, with the nearest dwellers on the opposite side.

The whole tract is absolutely bare of vegetation except margins of lakes and hundreds of lakelets, which are sometimes fringed with sod. No game trails are found above the timber line, and all



upper waters are destitute of fish. A few aboriginal arrowheads and obsidian chips, picked up near the divide, proved the only evidence of occupation by man that came to the knowledge of a surveying party under charge of the writer during the summer of the year 1898. No sign of the axe, nor anything like remnants or scars of camp fires were seen even at the timber line. The inevitable and irrepressible tin can, which mainly constitutes the kitchen midden of the present nomad the world over, was conspicuous by its absence.

Reference is here made to the unmapped tract northeast of the Yellowstone National Park, which in the course of exploration was conveniently designated as The Granites. Its position is between the Stillwater and Rocky Fork. It compasses the numerous head-

waters of the East and West Rosebud, flowing to the north, and of Crazy Fork and the Broadwater—upper tributaries of Clark's Fork. All of these mountain streams are waters of the Yellowstone.

This designation is in distinction from the easterly division of the same range known as the Beartooth, a less elevated mountain plateau, culminating in Beartooth Mountain of Wyoming.

Both The Granites and the subordinate Beartooth plateau, thus distinguished, form a part of the Absaroka division of the Rocky Mountains in southern Montana, or of the Snowy Range of Montana, as discriminated from the Absarokas of western Wyoming. These ranges are separated by Clark's Fork Cañon. Near the head of its lowest tributary, but bearing the name of Clark's Fork, lies Cooke City in an amphitheatre of mountains at the base of Index and Pilot peaks, at an elevation of 7,645 feet.

Whatever importance may attach to this mining camp within the original purpose of its location some twenty-five years ago, speciai advantages of position are not to be denied, even by those who fail to esteem a degree of isolation all but complete. In the deep valley of Soda Butte Creek nestles the "city" like a Swiss village. The mountain sides are covered with balsam and spruce. Republic Mountain (10,225′) stands out from the rest of the Index base, indented and hollowed out by erosion into lofty coves—or culs-de-sac—common to the lava summits of the region. The great gently undulating reef of paleozoic limestone, which is so bold a feature in the Index base on Clark's Fork, here likewise presents sharp-cut edges, weathered into long stretches of bluff. The base of all the surrounding mountains is the granite complex, a part of the same expanse and uplift that culminate in Granite Peak. The great plate of conformable limestones, belonging to the Silurian and Carboniferous series, spreads out beyond the Stillwater, and save where bared and sculptured by erosion is penetrated and overflowed with volcanic rocks surmounted with andesitic lavas. Clark's Fork probably follows in part a line in a great vertical fault plane, no extension of the limestone appearing north of the Index base, at the foot of which flows this rapidly gathering stream. At the extreme head of the Clark's Fork bottom the limestone, however, is still in force in Sheep Mountain, beyond which on the same meridian to the north all trace of it disappears. The Post Laramie re-elevation of the granite has cut it off. If ever borne to lofty altitudes by this uplift, its destruction by erosion has been perfect. No remnants of anything of the kind are to be found in the glacial gravels and alluvions of the high mountains. All the

valleys descending to Cooke are from local glaciation, except that of Miller Creek, which is excoriated by fluvial erosion from the limestone series. Ancient surfaces of the granite base are everywhere ice-smoothed.

Whatever may have been the title to the honor of giving to Cooke its name—it might have been not inaptly known as Pass City, if "city" it must have been. All mining camps in its day and generation in the Absarokas were *cities*. Nye City, at the northern base of The Granites, has passed from off the face of the earth. Solomon City and Lake City had their rise and fall. Both are deserted villages, which seem to have been abandoned in haste, without removal of goods and chattels. Of all the "cities" of the mountains in southern Montana, Cooke alone survives, though its population has dwindled from 500 to less than 100. A carriage road, such as it is, between Mammoth Hot Springs and Cooke, through the National Park, follows the water gap of Soda Butte Creek. Its extension over the Soda Butte divide gives access to Clark's Fork and the Big Horn Basin by way of Dead Indian Hill. At the head of Clark's Fork are two passes over the Stillwater divide, namely, West Pass (9,694′), between Henderson Mountain and Scotch Bonnet, and East Pass (9,717′), between Scotch Bonnet and Sheep Mountain. Other and better known passes are Chimney Rock (9,608′) and Black Warrior (9,654′), separated by Crown Butte. All are within a stretch of two miles, and descend into the Stillwater Cañon, which affords a horse trail through The Granites to the open prairie to the north. Another more elevated pass at the head of the Stillwater, over the Slough Creek divide, is known as Wolverine. If for no other reason for existence, Cooke holds its place as the natural gateway for whatever travel finds occasion so far from beaten paths. Pleasure travel in the National Park seldom extends to the northeast corner of that domain, from which Cooke is less than three miles distant. In point of the picturesque, it is excelled by no scenery within the Park, which indeed, full of wonders as it is, offers to the tourist but little temptation to linger. A summer climate at high altitudes finer than that of Cooke would be difficult to find, and a more attractive landscape hardly possible.

But a single water gap cuts through The Granites, that of the Stillwater. This stream, in fact, borders the western edge of the group, so distinguished from the rest of the Snowy Mountains of Park and Carbon counties.

Outfitting at Bozeman with nine pack and eight saddle animals,

fresh from the range, the writer's party, eight persons in all, reached Cooke July 24, from Cinnabar, after a detour of a few days in the National Park. From the Grand Cañon of the Yellowstone, the Mt. Washburn trail was followed to Tower Falls and Baronett Bridge.

A pest of horse-flies, more or less annoying on the park highways in the heated part of the day, came to an acute stage on the last day's march, greatly to the suffering of the animals, some of which were beside themselves. From these vampires there is no escape in mid-summer except in a strong breeze or at the higher altitudes. For persistence and execution they outdo all insect kind. As an inevitable and unmitigated nuisance and "kill-joy," abominated by the nerves as well as the flesh, the horse-fly of the Rocky Mountains takes precedence. His bite is that of the carnivora. While horse-flesh is exquisite to his taste, he does not refuse to whet his appetite on any blood that circulates or even on hanging meat. He loves a man next to a horse, and the shelter of a tent strongly appeals to his self-indulgent nature.

It is hardly necessary to explain that movements of a party in the wilds of the Rocky Mountains are more or less governed by provision for pasturage, any other kind of forage being out of question, and indeed quite beyond the craving of range animals. Knowing no other subsistence than that of the range, nor any keener relish than for bunch grass, all supreme conditions are fulfilled where this is to be found, even though at some distance from camp. Almost any growth of grass answers in a pinch or in default of bunch grass. Under the hands of skillful packers, who are generally owners of the animals, and, therefore, sure neither to overburden nor to encourage long marches, a lot of pack animals come out of a season's work but little the worse for wear, and usually sleek and muscular, if not plump and even fat. A tethered bell-mare and a few faithful followers, hobbled, serve to keep the drove fairly together when turned out to graze.

A plane-table survey to connect with published sheets of the United States Geological Survey was started at Cooke, not without difficulty. As the "city" has never been astronomically located, and the guide meridian of the United States General Land Office Survey is certainly out of the way, nothing remained, for want of other equipment than plane table and alidade, but to occupy and locate commanding summits, like Henderson and Republic mountains, by the three-point method, with lines to established summits as located on National Park sheets of the Geologic Atlas, or as astro-

nomically determined in a few instances in advance of topographic work. The location of Cooke followed in the course of much skirmishing for points, and was finally satisfactorily checked. This arduous work was executed by the younger members of the party—all sturdy climbers.

In order to advance into the mountains, of which little or no knowledge had been gained at Cooke from prospectors and hunters, a march was made to Kersey Lake at the end of the wagon road to the north. From the meadow beyond a hay scow with the dunnage was poled to the head of the lake, whence a trail was scouted and blazed by two of the party to the mouth of the cañon of Crazy Fork. Explorations toward the divide developed the practicability of getting the animals up to the timber line. This was accomplished after pioneering a trail with axe and shovel, and camp moved to an elevation of 9,230 feet near good forage at the head of Crazy Fork—an ideal site for an elevated camp, in an amphitheatre of granite bosses. Except arrow heads and chips, pointing to remote excursions of Indians, no signs were about of previous visitors. These were found on the shore of Island Lake at the head of one of the tributaries of the East Rosebud.

The ascent of Mount Dewey from camp and return proved a good climb for a long August day. This commanding snow-capped mountain, which crowns the divide, was so-named in honor of a friend, the echo of whose valiant exploits at Manila reached the surveying party at Cooke. Owing to treacherous mountain weather, including cloud-bursts on the summit driven by furious gales, the ascent was time and again made in vain only to be repeated. Plane-table and photographic work was only accomplished after several attempts not without exposure to the elements at their worst, enough to tax the endurance of the most hardy. The ascent from Camp Timberline was by way of two intermediate ridges, dissected into summits and draws. Explorations in several directions were all necessarily through steep gorges and water courses, choked with granite blocks of all sizes, piled *en masse*, the water tumbling far beneath. Such climbing, at the best arduous and sometimes difficult, becomes after nightfall extremely hazardous. The way, then, was sometimes missed by returning explorers and camp tardily reached only by happy chances, aided toward the end by reflections from fires kept burning as beacons by anxious watchers. The exertions and danger of night work of this kind over such rugged and pathless ground were speedily forgotten in ready welcome and good cheer. So, too, were all admonitions against recurrence of like

adventures, of which the worst, perhaps, were apprehensions in camp of accident, with wide scope for grave imaginings. To wanderers themselves, thus benighted, always opened the cheerless prospect of a frosty bivouac without shelter, fuel or food, and perhaps in rain and sleet, a thunderstorm after midnight proving within the experience of the party the rule rather than the exception. The probability of such a misadventure, though perhaps the least serious of many possibilities, little tended to allay the solicitude of the rest of the party.

Mt. Dewey drops off some 2,760 feet into a deep cañon on the north side, with a sizable glacier at the head, and ending in a deep lake to which the name of Cañon Lake was given. This is one of a series of lakes connected by the East Rosebud, of which Island Lake, at the foot of Mount Dewey, is the highest. The Rosebud outlet of Cañon Lake into Long Lake plunges 200 feet in falls. A little below the latter, about two miles above the grand cañon of the East Rosebud, this stream again plunges in splendid falls.

Island Lake (9,987 feet) appears to be identical with the lake indicated on the map of the General Land Office as the head of the East Rosebud; its name is therefore retained. It is easily reached from Timberline Camp by Pavement Pass, near the divide. This name was suggested by a remarkable tessellation of granite blocks, worn by ice and water to the smoothness of a city pavement.

The Broadwater, the head proper of Clark's Fork, takes its name from characteristics of its lower course. Like Crazy Fork, to the east, also a tributary of Clark's Fork (of the Yellowstone), it heads at the divide in ice-formed lakes, of which the overflow is through a series of lower lakes separated by deep cañons, mostly gorged with granite blocks fallen from the precipitous walls. The descent of Crazy Fork is the more rapid, and over two falls, both below its box cañon. Still further below, the forces of gravity and weathering agencies on its perpendicular walls are attested on a grand scale of destruction. The bottom is strewn with gigantic blocks many-deep, which likewise pile up in an immense talus against the east wall.

Above the timber line the granite is washed clear of soil or small detritus; it is strictly bare and barren. In circumstances favorable for preservation of ice-smoothed surfaces, these evidences of glaciation are frequently perfect. On many a towering mass no footing can be found ; no passage anywhere is effected except by climbing.

The granite is of two periods, the earlier being probably of Archean age, and the later dating from the Post-Laramie eleva-

tion. The latter, a more or less foliated and basic variety, is involved in the former, which is extremely feldspathic, and often of pinkish complexion. Trap and porphyrite dykes traverse the granite complex. On Crazy Fork porphyritic intrusions were seen only in Dewey Mountain. Toward the west porphyritic dykes in great number bring in a type of topography quite distinct from the type prevailing at the upper waters of Clark's Fork. It is asserted by serrated ridges and less expansive massifs, owing to unequal erosion and disintegration between the several kinds of rock. Throughout the broad granitic base of the Snowy Range, both in Montana and far to the south in Wyoming, the same distinctions and relations are observed.

From Camp Timberline The Granites were explored as far as practicable. Returning to Cooke by the same trail, now well-trodden by traffic between Cooke and the high camp, the party divided from a camp at Sheep Mountain in the Clark's Fork bottom for several fields of exploration. In persistent wet weather a party of three, composed of Messrs. A. B. Wood, A. B. Wilse and Russell Kimball, made trail with pack and saddle animals to a bivouac at Goose Lake (9,730 feet), afterwards remembered as Camp Misery, the animals returning the same day. The rest of the outfit moved up two days later, arriving in a pelting hailstorm. The mountain party with the plane-table came late into camp drenched to the skin. Although the special performance of the one folding camp-stove in camp was fumigation from every joint, it proved for several days an object of unvarying attraction and solicitude. A few weather-beaten spruce, straggling above the timber line, afforded necessary fuel. A foot trip from here was made to Grasshopper Glacier, just over Goose Lake pass, between the Stillwater and the West Rosebud.

The névé of this remarkable glacier is shared by the summit of Zimmer Mountain and Mt. Wilse. It mantles the saddle between two of the upper waters of the West Rosebud. An island of granite and porphyrite blocks and detritus occupies the western descent. To casual observation, this insulated tract appears to be ice-floated, an impression not easily dispelled in setting foot upon it. Motion is implied in the most alarming manner, huge blocks of granite under one's immediate eye becoming displaced, especially on the lower side, with internal and external sounds that dispose to flight. Tons of rock were violently shifted while the writer was skirting the lower edge, so that safety was sought in the slushy surface of the glacier.

From the absence of anything like a descending train of blocks, it seems probable that this islet actually rests on a solid foundation, the surface being in an advanced stage of dissolution. Like the two islets of the Brenva Glacier of Mt. Blanc, it is completely involved in plastic ice, which, bending about the obstruction, exerts an immense pressure on all sides and superficial edges of the islet. To the creeping ice mass, with its internal molecular movement, these edges offer an encircling surface of least resistance. The slope of the surface of the glacier is at an angle of not less than 25 to 30 degrees. Hence accelerated flow toward the top—especially under action of the sun. The emission of sounds on the islet is doubtless incidental to displacement and crushing of blocks of rock at shallow depths in this irresistible grasp of ice.

A really astonishing feature of the glacier is the one which naturally has given name to it, as known to prospectors from Cooke. Myriads of grasshoppers, in periodic southward flight from the prairie, have succumbed to the rigor of cold and wind, to be engulfed in the snow and finally entombed in the ice. Thousands of tons of grasshopper remains are the principal morainal material fringing the lower edge, washed out in furrows wherever by action of the sun the surface has been grooved into runlets of descending water. No fragment of ice can be broken so small as not to contain grasshopper remains, melting and regelation having torn all but a small proportion of the fallen insects into a coarse powder, only the more enduring parts having resisted reduction. Grasshoppers that gained the west side of the pass seem to have been laid low before further descent, all congealed patches of snow in the pass likewise being charged in the same way.

The plates, taken on different occasions by Mr. Wilse, of Seattle, photographer of the survey, successfully bring out in curvilinear form lines of surface motion—aided by deep coloration imparted by furrows of grasshopper remains, washed out by runlets and naturally disposed in parallel lines. It requires a number of plates to present the ensemble of the Grasshopper Glacier and also of the Sawtooth glaciers. A panoramic collection of views exhibits this, as far as practicable without more time and labor than could be given to photographic work, especially in the treacherous weather which prevailed. The summits of Mount Wilse and Zimmer Mountain were observed in cloud, and the upper parts of the névé lost to the camera. The views taken were at the cost of indefatigable labor and hardy endurance on the part of the photographer, who combines with professional skill in field photography rare accom-

plishments as a topographer, along with sturdy qualities as a mountaineer. Remains of individual grasshoppers were also found in the upper edge of the ice-sheet formed beneath the snow crests of Mount Dewey. The ice in such circumstances not being subject to movement, the entombed insect is preserved in perfect form.

The timber line camp at Goose Lake was left September 3d, after a heavy fall of snow incidental to a spell of wintry and gusty weather, from which even range horses, without their winter coats, suffered not a little. All of the animals, when driven in for saddle and pack, were sulky and disposed to buck. Camp was again pitched at the Sheep Mountain camp on Clark's Fork. Three days later Messrs. Wood and Wilse, taking advantage of a favorable turn in the weather, were again escorted to Goose Lake for a night camp, whither the following morning they set out foot-loose, in light marching order, for a hard trip across The Granites to the mouth of the grand cañon of the West Rosebud. At the end of the fifth day the explorers joined the rest of the party in camp, on the Stillwater, near the mouth of the West Fork, none the worse for their exposure, but with foot-gear, together with much of their other rig, in the last stages of dilapidation.

The Sawtooth summits had been visited, and a number of high peaks ascended. To some of these names have been given, as follows: Mount Villard (11,500′); Mount Spofford (11,580′); Mount Fox (11,000′); Mount Wilse (11,611′); Mount Wood (12,486′); and Mount Hague (11,800′). Aneroid elevations were determined for a further number of important points.

As camera and plates could not be taken along, no photographs can be given of the most rugged scenery of all. The plane-table also had to be left behind. Several of the mountains named above were scaled and approximately located by angle and azimuth with pocket instruments. Of the whole number, including Granite Peak, which was scaled to an elevation of 11,447 feet, only Mt. Wood can be seen from the prairie at the northern base. From a greater distance a dense array of crests comes into view—thus far, except Granite Peak, without identification.

A fine glacier is supplied from the expansive névé culminating in Granite Peak. Its descent is into waters of the West Rosebud.

Mt. Wood is the highest of three peaks of the expansive massif fronting the range and rising grandly from Rosebud Cañon and the snow fields above. The name given to this mountain, previously unnamed, so far as could be ascertained, is in honor of my friend and companion, who took its elevation, and to whose aid and energy

in mountain-work many of the more important results of the survey are to be ascribed.

From the Stillwater the Snowy Range of Park County was crossed by the picturesque Lodge-pole trail to Boulder Creek over several passes. The cañon of this beautiful mountain stream was followed to the upper waters as far as the deserted mining camps of Independence and Solomon City. Crossing the several timbered divides to the East Fork of the Boulder, Slough Creek and Lake Abundance, the old camp at the head of Clark's Fork was reached Sept. 26th. Two days later in-door quarters were again occupied at Cooke. On Oct. 4, under bright skies, after a snowstorm lasting five days, march was resumed, this time for Red Lodge, over the Beartooth division of the Snowy Range from Smith's Ranch of Clark's Fork. All trails in the mountains were snowed under, and blazes proved misleading. Messrs. Wood and Wilse took up separately the work of finding and breaking trail, occasionally coming together, however. The horse-tracks now of one rider, and now of the other, were followed, always with the conviction that the wrong choice had been made. Steps were often retraced to avoid windfalls. Snow fell from every passing cloud. In night camps pitched in deep snow, the one shovel was in constant requisition. Greatly to the relief of the whole party, the pathfinders came into late camp at the end of the second day's march on Little Rocky Creek, after abandoning hope of being overtaken by the "outfit."

Having dropped too low into the cañon of that creek, egress was found the next morning by a hard climb. The high plateau, culminating in willow-swamp bottoms separated by low divides, was reached about noon in a dry blizzard, increasing toward night, Messrs. Wood and Wilse still scouting in the lead, but to little purpose, as their tracks were soon covered by driven snow. No way down from the snow field practicable for pack animals appearing in sight, a single tent was pitched for the night and the animals turned out to forage beneath the snow.

In spite of driving snow and bleak winds, blowing out of a clear sky, perhaps at 60 miles an hour, packers and cook chose to sleep *al fresco* rather than shake out the frozen canvas. Any hope of sleep inside the tent was dispelled by the fury of the wind, and all surviving energy of the single occupant devoted to the sole purpose of keeping up the tent. What consolation could be had from a smoking stove was impaired by constant danger of conflagration from frequent displacement of the funnel, or from final collapse. The canvas stood till morning, when in a neglectful moment the expected hap-

pened, but at a time when assistance was at hand, and the danger of fire averted.

The pathfinders, not having come into camp, were safely presumed to have sought refuge from the tempestuous heights in the bad-lands below. A difficult descent, as afterwards recounted, had been separately made toward night down the steep sides of the lower cañon of Little Rocky Creek. After dragging their own reluctant horses half way down, and finding the way impracticable for pack animals, Mr. Wilse bravely climbed up again afoot to turn off the train from following—by conventional signs to that purpose scratched in the snow. Both reached the bottom about the same time by different courses, but again met on the desert below after dark under the friendly roof of a prospector—thanks for the rendezvous to Mr. Wilse's forethought in setting a candle at the window-pane for his companion.

The wind-stormed "outfit" on top, after some scouting in deep snow, made the descent the next day down the south side of Bennett Creek—striking a blazed trail in the timber. This proved to be the end of the Sheridan trail, which had failed to show up in the mountains. The drop of some 5,000 feet into the bad lands of the Big Horn Basin, near the scene of Miles's battle with the Bannocks, was into comparative summer. The Rocky Fork and Red Lodge trail had been missed at the head of Little Rocky Creek, which should have been left to the east.

After needed rest and forage for the animals, preparatory to their return to Bozeman, the party disbanded October 11th, having been 102 days in the field.

Buffeted by high winds and by frequent snow squalls from the mountains, which had become the centre of almost continual storm, camp on Rocky Fork, above Red Lodge, was kept for a few days longer by two remaining members of the party while preparing for a further excursion to the Sunlight Basin in the Absarokas of Wyoming. The shelter of a wall and an A tent had come to be most precarious, and cooking by open fires impracticable. A new stove made for the emergency at Red Lodge proved equal to all purposes. The road was taken October 21 up Big Horn Basin over Dead Indian Hill. A light winter outfit well loaded the body of the Shutler wagon. No snow lay upon the basin a few miles south of Red Lodge. The whole of it is given over to sheep herders with flocks of over a thousand head. Several cosey looking camp wagons, not unlike such as are often seen in gypsy camps, passed on a day's drive,

seemed something at least in the void of a shepherd's life with no companions but his collies and flock.

Unbounded hospitality was found at night at Andrew Chapman's fine ranch on Pat O'Hara Creek.

Dead Indian Hill (8,365′) and creek of the same name at its western base take their name from an incident in one of the numerous Indian fights for which the northwestern part of the Big Horn Basin and the bordering foothills of the Absarokas of Wyoming are memorable. The Sunlight and Cooke wagon road crosses the divide between two branches of Clark's Fork, on a grade perhaps unequalled by that of any other wagon road in the country. The descent of 2,015 feet is made in less than one and a half miles, including a stretch of gentle grade half way down. The descent with heavy wagons is rarely effected except by "snubbing," that is, by felling a tree at the top and attaching it as a drag to the hind axle. These are commonly dropped half way down at the beginning of the reducing grade, not without occasional necessity of repeating the operation farther on. Thousands of snubbing trees pack the roadside. The roadway is obviously the development of a mountain trail. Numerous "cut-offs" have been made by range cattle driven into the Sunlight Basin for summer forage, and back to winter ranges and home ranches at the end of the season.

The descent of Dead Indian Hill on the occasion within the present recollections was made with ordinary brakes, sadly out of condition—the driver only keeping to his seat. On the lower pitch, the steadiness of the team and ready assistance alone prevented an upset from shifting of the dunnage over the wheel.

Notwithstanding moderate weather in the Sunlight Basin, a projected visit to the Sunlight mines on the Sunlight and Stinkingwater divide of the Absarokas (12,000′), was reluctantly abandoned, the mountain trail having already been snowed under, and the miners compelled to descend for the winter, by sliding down the mountain side, not without mishap.

The return to Red Lodge was with pack animals down Clark's Fork box cañon to the end, and thence by the same general course as before over the foot-hills of Beartooth Plateau.

The display of paleozoic and mesozoic strata at the mouth of Clark's Fork cañon is complete in a great fold—incisively truncated by erosion. This uplift is a part of the sharp rise of the same series marginal to the Beartooth Range and The Granites, on the flanks of the granite complex. One of the limestones of the paleozoic series in nearly vertical attitude, which it shares with other members,

weathers into serrated forms, whence it may be presumed the name applied to the former division of the Snowy Range. Some of these forms are exquisitely picturesque, owing to unequal erosion and disintegration. Occasional perforation of towering outliers adds to the castellated effect.

The Post-Cretaceous re-elevation of both sub-divisions of the Snowy Range division of the Rocky Mountains—coincident, as may be assumed, with the intrusion of the more recent granite, is evidenced by the continuity of the remarkable coal series of Rocky Fork without material change of dip well into the foot-hills, until finally faulted. But the plane of fault has not yet been reached by the great mine at Red Lodge.

On November 1, a visit was made by wagon to the camp of oil-well borers at the asphaltum deposit on Butcher Creek near the mouth of East Rosebud cañon at the northern base of The Granites. An incident of this visit may perhaps be related. A 12 x 16 wall tent, already but badly pitched, offered shelter to the writer. The folding camp stove was set up inside, for heating and cooking purposes, on an old bed of ashes which it failed to completely cover. An A tent was raised alongside for the rest of the small party. Toward evening half a gale sprang up from the mountains, veering round from their lee to the northwest and steadily increasing until about midnight, when it had risen to about 70–80 miles an hour. In a furious blast down went the A without resistance on the part of the two men underneath, one of whom, with more nerve than nerves, stuck it out till morning, not without a grim sense of amusement, as afterwards confessed, at the struggles going on in the wall to avert a similar collapse. All struggles proved in the end quite in vain, when guys were rent and even eyelets torn out. Decidedly the worst of the resulting chaos of raiment, bedding, stove, camp-kit, etc., proved the saturation of every article with flying wood ashes from under the stove, which fortunately had been suffered to cool and fall to pieces early in the night. Remnants of supper and thrifty provision for breakfast, all came under the searching blight of ashes. Only daylight revealed details of the hopeless havoc that had been speedily wrought. Meanwhile, refuge was found in the borers' cabin at a moment when their framed derrick, the work of a season, came down with a crash. The rest of the night was miserably spent in the cabin, with the interruption of occasional flying sorties out into the gale to rescue some precious instrument, or coveted article of clothing from under the lashing canvas. From beneath the A

everything had soared away, except blankets under the weight of their imperturbable possessor. Habiliments, considered important among polite people, were missing, but finally recovered from the brush. Minor articles, usually worn in pairs, never found their mates. If one side of such a provoking and embarrassing situation was more than another impressive—so appeared the ludicrous side. No further nocturnal adventure of the kind, however, proved necessary to force the conviction that endurable conditions for camp life had come to an end for the season. Differing from this one only in degree—numerous vicissitudes, wrought by wind throughout October, had indeed left but little of it worth living. The one tent belonging to the outfit was folded for the last time, and all further attempt relinquished to complete the Cooke City sheet from the north side of The Granites.

The Granites afford, perhaps, the most picturesque alpine scenery to be found in accessible parts of the United States. As a haunt for tourists of the more adventurous sort, and for alpine clubs, they offer superlative attractions, coupled, however, with difficulties not easily overcome. Allusion is here made to the stark sterility of the high parts, and to excessive demands both in physical exertion and expense in providing ways and means for occupying them. Proximity to the National Park suggests eventual addition to that domain. Except for picturesque value they are worthless. The trail blazed on Crazy Fork, well up toward the divide to the timber line, will probably prove the most available for future travel. With some improvement this trail from Cooke could be made popular for mid-summer use. In any other season The Granites, as well as the Beartooth plateau, constitute a storm centre to be scrupulously avoided. Physiographical as well as meteorological conditions all tend to such a forbidding characterization. Granite Peak and Glacier, and Wood Mountain are more directly reached from the prairie with one of the Rosebud bottoms as base of supplies. The cañons of both Rosebuds are impracticable for animals above a mile from the prairie. Few pedestrians have ever attempted to cross The Granites from the north side, and none, so far as I am aware, successfully. It is conceivable that from the Beartooth plateau, where forage is abundant, reached from Red Lodge, access may be found to the culminating parts of The Granites.

Mr. Wilse's photographs of the several glaciers above described attest beyond all question the incorrectness of Mr. William H. Holmes's conclusion that nothing "approaching a glacier in appearance" is to be found "even in the centre of the great mass about

the sources of Clark's Fork and the Rosebud." Mr. Holmes's remark is, that he was "unable to discover anything" of the kind, referring to explorations of the Hayden survey (1878). (See U. S. Geol. Survey, Fifth Ann. Rep., 1883–84, p. 347.) That the high parts of The Granites of the Snowy Range, or sources of the streams mentioned, were not visited by that survey is sufficiently clear from its several reports. Nor do any of these powerful glaciers appear in Russell's List of North American glaciers. So far as the writer is aware, no description nor even mention of any of the number has previously appeared in print, except a short account of the Grasshopper glacier—said to have been recently contributed to a local journal by one of the packers of the survey, of which the present pages are a brief narrative.

Approximate elevations, in feet, from aneroid observations, computed by difference from Guyot's table. (Short & Mason's barometer.)

Red Lodge, N. P. Railway station	5,531
Cooke City	7,645
Mouth of Republic Creek	7,592
Republic Mountain	10,225
Republic Pass	10,046
Republic Mine	8,122
Woody Mountain	8,065
Pilot Ridge	10,506
Pilot Ridge, top of limestone cliffs	9,147
Index Peak, highest point scaled	11,222
Soda Butte Pass (Soda Butte and Clark's Fork divide)	8,064
Black Warrior Pass (between head of Miller Creek and Stillwater)	9,654
Chimney Rock Pass (between Crown Butte and Henderson Mountain)	9,608
Lulu Pass (between Fisher Mountain and Scotch Bonnet)	9,718
Bull of the Woods Pass (between Scotch Bonnet and Sheep Mountain)	9,694
Henderson Mountain, west summit	10,233
Henderson Mountain, east summit	9,984
Daisy Mine, Clark's Fork, upper tunnel	9,797
Kersey or Burke Lake	8,123
Panorama Point	8,638
Sheep Mountain	10,418
Crazy Fork Meadow, mouth of Box Cañon	8,371
Timberline Camp	9,230
Island Lake, head of East Rosebud	9,767
Mount Dewey	11,753
Point Lookout, near Kersey Meadow	8,650
Glacier on Granite Mountain	11,300
Point reached on Granite Mountain	12,371
Zimmer Mountain	11,310
Mount Wilse	11,611
Long Lake, West Rosebud	7,645
Grasshopper Glacier (div. bet. West Rosebud and Broadwater)	10,677

Grasshopper Glacier, base of islet	10,513
Goose Lake	9,756
Goose Lake Pass	10,575
Sawtooth Mountain	11,310
Mount Fox (estimated)	11,000
Mount Villard	11,500
Mount Spofford	11,580
Mount Hague	11,800
Wood's Peak (Timberline, 9,634)	12,486
Point of photographic view of Grasshopper Glacier	10,646
Watershed, between Broadwater and Stillwater	9,414
Long Lake (above Rosebud Falls)	7,645
Lake below falls, Rosebud Cañon, head of wagon road	6,582
Stillwater, mouth Goose Creek	7,911
Stillwater, Pratton's Ranch	5,114
Lodge Pole Pass	7,419
Lime Butte	7,759
Divide, bet. upper Deer Creek and Elk Creek	7,722
Smith's Ranch, Clark's Fork	6,817
Beartooth Lake	8,937
General watershed above Beartooth Lake	9,545
Nutting's Ranch, Clark's Fork, at Bennett Creek	4,952
A. Chapman's Ranch, Pat O'Hara Creek	4,760
Bald Ridge	7,994
Dead Indian Hill	8,365
J. R. Painter's Ranch, Sunlight Basin	6,784
Mouth Clark's Fork Cañon, T. Brown's Ranch	4,090
Clark's Fork Cañon, Sunlight Trail crossing	4,430

EXPLANATION OF PLATES.

I.—Zimmer Mountain and Grasshopper Glacier. Islet to the right. Goose Lake Pass, between Zimmer Mountain and South Sawtooth peaks, to the extreme right. Part of Fox Peak (named in honor of Dr. J. M. Fox, of Red Lodge) in the distance to the right.

II.—Base of Grasshopper Glacier on Zimmer Mountain. Islet on extreme right. Mt. Wilse in immediate background of glacier. Mt. Villard (named in honor of Mr. Henry Villard) in the distance. Mt. Spofford (in honor of Mr. C. A. Spofford) on extreme left.

III.—Sawtooth massif and névé field. South Sawtooth on extreme left. North Sawtooth in background. Part of Grasshopper Glacier in foreground to extreme left.

IV.—Combined plates 31A—32A. Second Lake at head of the Broadwater. Glacier to the right at E. N. E. base of Granite Peak. Glacier to the left has its névé on Mt. Villard—the snow-clad peak to the left of it. The rocky summits are a part of the Mt. Villard massif. The first lake at the supreme source of the Broadwater, at the foot of Mt. Villard, lies behind the lake in the foreground.

V.—Glacier Lake. At south base of Mt. Dewey.

Page 200: An index map to Geologic Atlas of U. S. Geological Survey. The sheet covered by private survey (1898) is indicated as COOKE CITY, and, further, by the writer's initials, J. P. K.

NOTE.—The above half-tone plates are from a collection of photographic views (8″ x 10″) numbering some 160. These have been bound in album form, and partially in panoramic connection, by the photographer, Mr. A. B. Wilse, of Seattle.

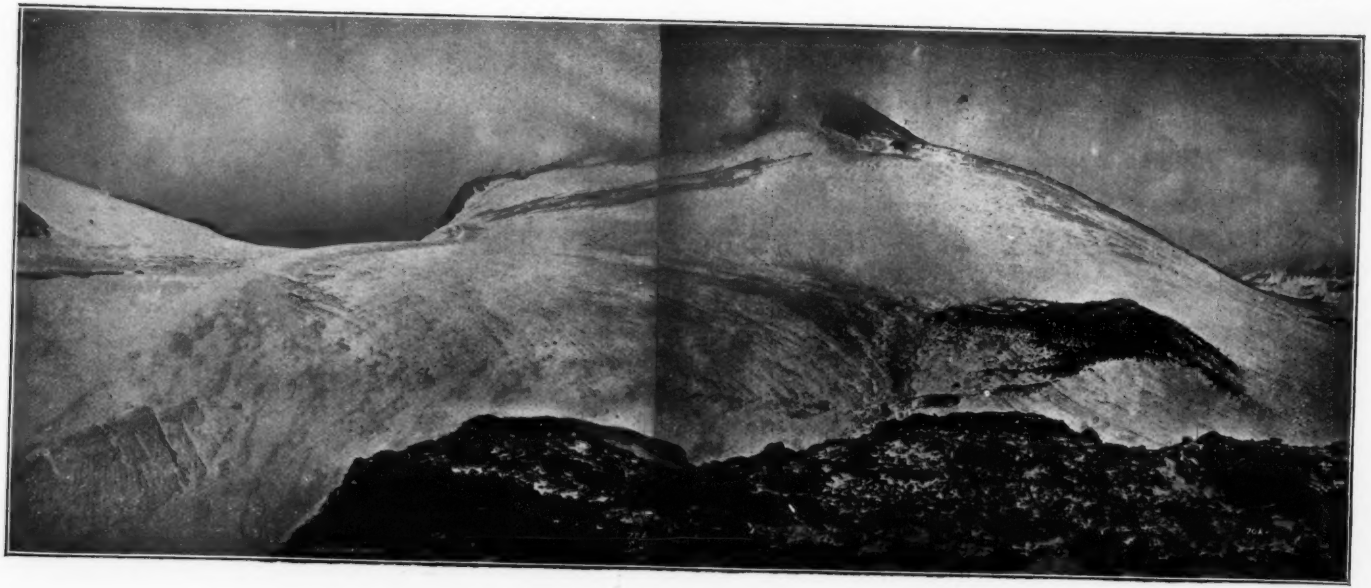
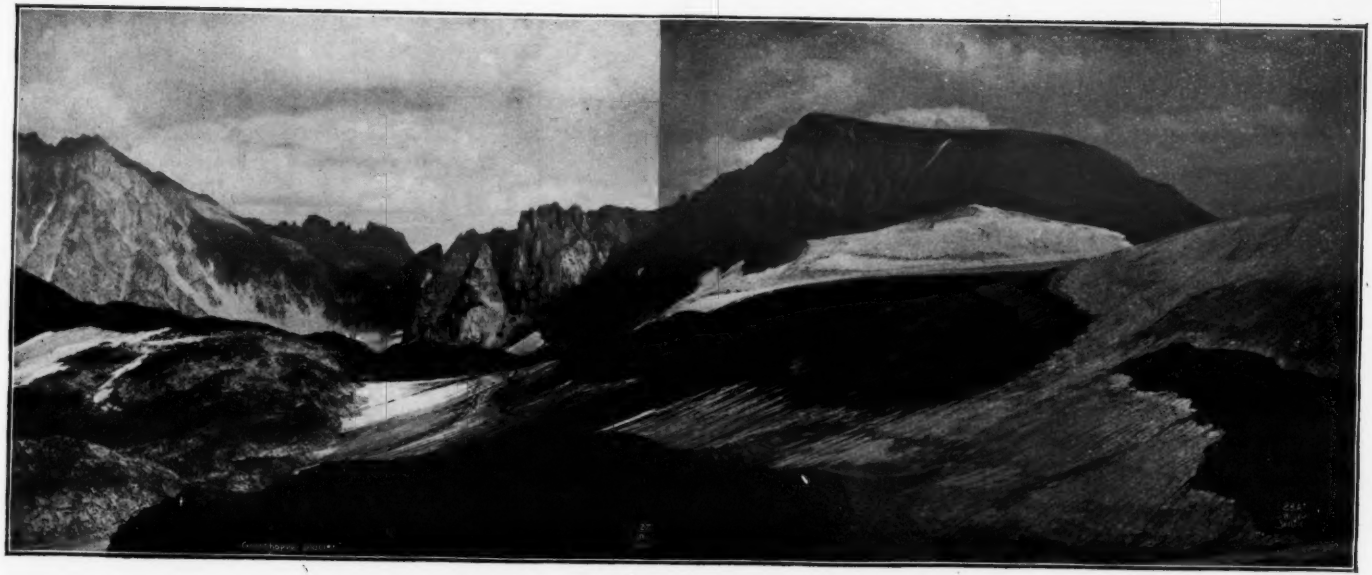


PLATE II



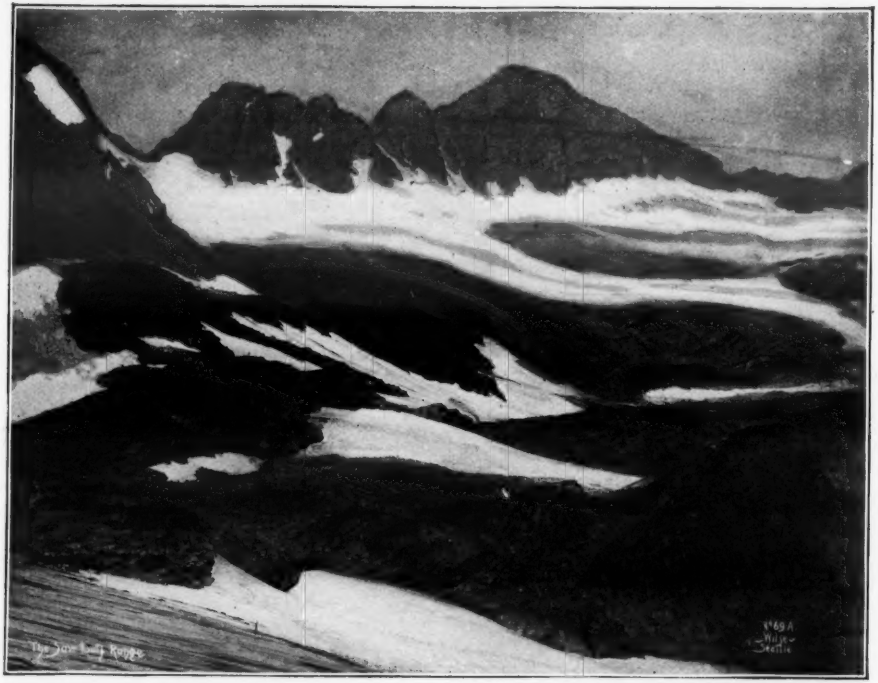
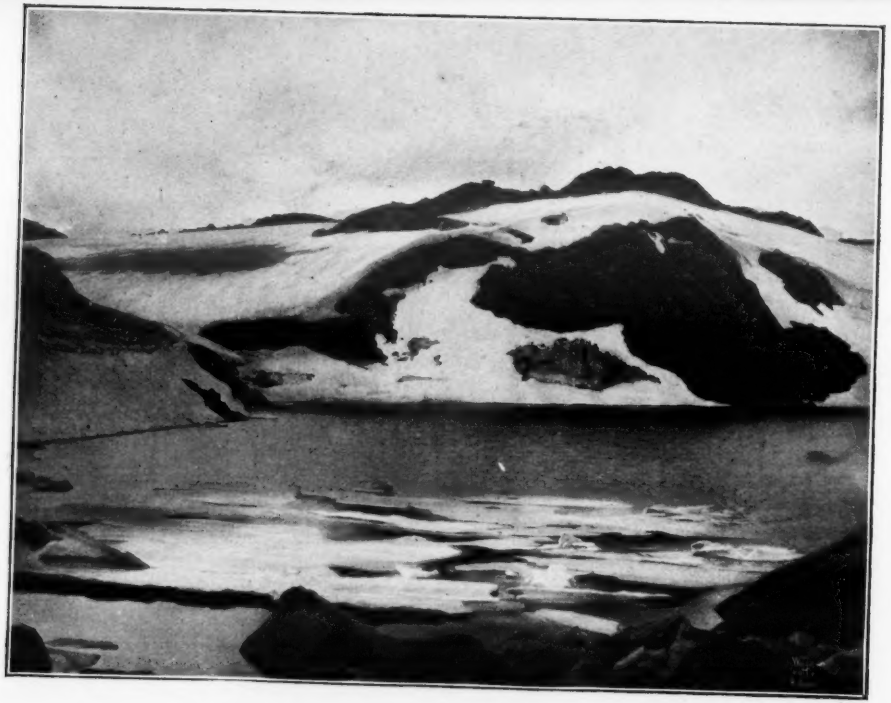

The Sawtooth Range
Wilson
Seattle

PLATE IV.


32 A
31 A
Glacier
Glacier

Plate V.



PHYSICAL GEOGRAPHY OF NEW YORK STATE.

BY

RALPH S. TARR.

PART VIII.—THE GREAT LAKES AND NIAGARA.

POST-GLACIAL HISTORY.—Indian trails in New York were located upon a gravel ridge, which later became the site of a road, known as the ridge road. This gravel ridge was early recognized as a lake beach. For instance, Governor Clinton* says that a lake evidently once covered this region, its level having been lowered either by an earthquake shock or by the enlargement of the outlet. Atwater† states that Lake Erie was once higher, covering the prairies of the Ohio region, and flowing into the Ohio, the level of this lake having been lowered by the cutting of the Niagara gorge. Bigsby‡ points out that elevated beaches prove that there have been fluctuations in the level of Lake Huron, and he also mentions the elevated beaches near the shores of Lake Ontario,§ as does Captain Basil Hall,‖ who recognized that Lake Ontario once stood higher.

Whittlesey** advocated beach origin for the ridges in Ohio, but pointed out the difficulty of explaining them, because of the absence of natural barriers. Later†† he studied these beaches more extensively; and, after proving that they were not strictly level, concluded that they therefore were not beaches, but probably due to marine currents, being in the nature of bars. The same author later studied the beaches of the Michigan region,‖‖ and stated that the lower ones were lake beaches, exposed to the air by a lowering of the outlet, but that the upper ones were more ancient, and due to a more perma-

* Coll. of the Hist. Soc. of N. Y., 1811, Vol. II, 94–96.

† Amer. Journ. Sci., 1819, I, 116–125. This is opposed by Wells, Same, 331–337, and by Bourne, Same, 1820, II, 30–34.

‡ Trans. Geol. Soc., 1824, I, 2nd Ser., 175–208.

§ Phil. Mag., 1829, V, 2nd Ser., 6.

‖ Travels in North America, Edinburgh, 1829, Vol. I, 167–170.

** Second Ann. Rept. Geol. Survey of Ohio (Mather), 1838, 55.

†† Outline Sketch of Ohio, 1848 (from Homer Historical Collections), 586–589; Amer. Journ. Sci., 1848, LV, 205–217; Same, 1850, LX, 31–39.

‖‖ Foster & Whitney's Lake Superior Rept., Part 2, 1851, 270–273; See also Whittlesey, Smithsonian Contributions to Knowledge, 1867, XV, Article II, 17–22.

nent elevation of the water. These studies of Whittlesey's were the earliest ones of marked importance, and it will be noticed that he recognizes some important features, such as the fact that the beaches are not level. Roy* found and described the beach terraces of Canada and ascribed them to inland lakes whose barriers had disappeared.

In New York, Hall† described the lake beaches and the ridge road, which he recognized as a true beach. The Erie terraces were also mentioned; and the terraced deltas of the Cayuga and Seneca valleys were explained as the result of former water levels, though he was doubtful as to the exact conditions then existing. Hayes‡ ascribes the beaches to ocean action, and Niagara gorge to the work of high and powerful tides. Lyell,§ who visited the terraces in both New York and Canada, in the latter country in company with Roy, and in the former with Hall, notes their remarkable general levelness, and asks how the barriers supposed by Roy could have been removed without disturbing this levelness. To account for them he supposes that they are marine, and that the land has been elevated vertically above the sea. Some terraces are believed to be beaches, some bars; and this difference in origin, together with variations in supply, and in original surface contour, *plus* a slight difference in amount of uplift, he believes will account for the measure of irregularity noticed.

Lapham‖ describes the lake clays near Lake Michigan; and Agassiz** proposes to account for the terraces which line the shores of Lake Superior by a change in the relative elevation of the lake and its shore, the change being in the land itself, not in the water. These changes were in the nature of paroxysms, causing frequent changes, and the cause for these paroxysms is believed to be the intrusion of dikes, of which large numbers occur on the shores of Superior.

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* Phil. Mag., 1837, XI, 201–202.

† Second Rept. Geol. New York, 1838, 310–314; 348–350; Geol. of New York, 4th Dist., 1843, 342–354; 661–662.

‡ Amer. Journ. Sci., XXXV, 1839, 95–105.

§ Phil. Mag., 1842, XXI, 548–555; Proc. Geol. Soc., III, 595; Phil. Mag., 1843, XXIII, 183–186; Amer. Journ. Sci., 1844, XLVI, 314–317; Travels in North America, Vol. I, 1845, 24; Vol. II, 85; 102–114. Considerable important work done in Canada by Roy, Fleming and others, and published upon in the Canadian Journal, Canadian Naturalist, and other Canadian publications, has not been examined, because I have not had access to sets of these journals.

‖ Amer. Journ. Sci., 2nd Ser., III, 1847, 90, 94.

** Proc. Amer. Assoc. Adv. Sci., 1849, I, 68–70; Lake Superior, Boston, 1850, 413–416; Amer. Journ. Sci., 2nd Ser., 1850, X, 98–101.

Desor* advocates marine origin for the beaches of Superior and Ontario, pointing out that they need not stand at the same level, some being formed in more exposed places than others, and some, after having been formed, being destroyed, while others are really submarine terraces (œsars). The marine origin is indicated by the distinctly marine terraces of the St. Lawrence Valley, in which marine fossils occur; and the changes in conditions have come as a result of the uplift of the land. On the other hand Chapman,† agreeing with Roy, advocates fresh water origin and assumes that this fresh water was held in lakes raised in level by some eastern barrier.

With the studies of the Ohio Geological Survey there began a more scientific investigation of the shore lines, and Newberry,‡ as a result of his studies, attributed the beaches to a vast inland sea, which gradually contracted, for some unknown reason, possibly local subsidence, or erosion along channels of drainage. He suggests that the exact cause will be known only after careful future study, which calls for a detailed tracing of the several ridges. He gives one of the first clear arguments for the lacustrine origin of the lake ridges as opposed to the marine.

Bannister,§ describing the beaches of Lake Michigan near Chicago, refers them to a former level of Lake Michigan and describes the outflow past Chicago, which is still recognized as a former outlet. This is one of the best early pieces of work upon the lake shores. Warren,‖ on the other hand, ascribes the beaches of the Red River valley, and some of the changes in the Great Lakes, to a change of land level.

It was as an assistant to Newberry that Gilbert** began his work upon the Great Lakes, a work which has produced such important results. He gave us the first detailed survey of a kind sufficiently accurate to be used in later mapping (Fig. 1). In connection with

* Foster & Whitney's Lake Superior Rept., Part I, 1850, 194–218; Same, Part II, 1851, 232–270; Bull. Geol. Soc. France, 1850, VII, 623–630; Bull. Geol. Soc. France, 1851, VIII, 420–423.

† Phil. Mag., XXI, 1861, 428–435.

‡ Proc. Boston Soc. Nat. Hist., 1862–3, IX, 42–46; Geol. Survey, Ohio, 1869 Report, 24–31; Ann. New York Lyceum Nat. Hist., 1870, IX, 213–34; Amer. Nat., 1870, IV, 193–214.

§ Illinois Geol. Survey, 1868, III, 240–242.

‖ Ann. Rept. Chief of Engineers, 1868, 307; Amer. Journ. Sci., 1878, CXVI, 416–431.

** Geol. Survey, Ohio, 1870, I, 488–495.

his work on the Maumee Valley,* Gilbert showed that the beaches must have been formed in lakes, because they converged toward the outlet channel past Fort Wayne, and that they have been tilted since formation. This tilting has later been used as proof that the change in land level was the cause for the change in outflow of the lakes and hence in the former lake levels. He also points out that, since they dropped from the level of the highest beaches, the waters of Lake Ontario have been at least seventy feet lower than now. This paper of Gilbert's marks a very distinct advance in our knowledge of the Great Lakes history.

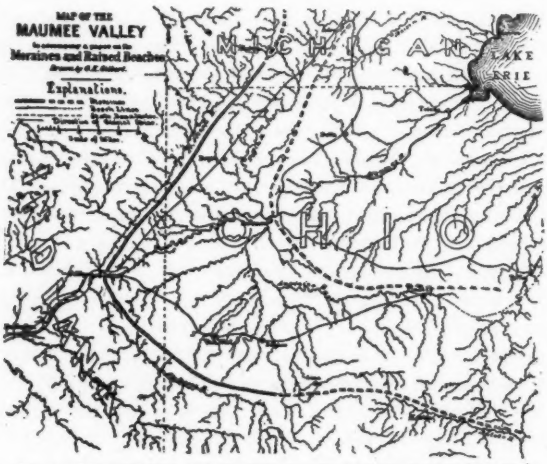

FIG. 1.—THE MORAINES AND BEACHES OF THE MAUMEE VALLEY (GILBERT).

Another assistant to Newberry, Professor Winchell, was also engaged in the study of some of the Ohio terraces, some of the lower ones of which he referred to beach origin, others to glacial moraines, modified by water. The elevation of the lake waters is ascribed to the freezing up of all the outlets. Winchell inaugurated the policy of giving names to the various lake ridges.† The ridges were still further studied and described by Orton‡ and by Read§ of the Ohio Survey.

* Proc. New York Lyceum Nat Hist., 1871, I, 175–178; Amer. Journ. Sci., 1871, CI, 339–345; Geol. Survey, Ohio, 1873, Vol. I, 537–56.

† Winchell, Proc. Amer. Assoc. Adv. Sci., 1872, XXI, 152–186; Geol. of Ohio, 1874, II, 56; 431–433.

‡ Geol. Survey of Ohio, 1873, I, 425–434; 438–449; 455–462.

§ Geol. Survey of Ohio, 1873, I, 488–492; 516–519.

In a foot-note to Gilbert's paper, Newberry* makes the suggestion which Gilbert and most other workers have since accepted. He says, "In the discussion of these facts cited by Mr. Gilbert, and others of similar character, it should be remembered that the retreating glacier must have, for ages, constituted an ice dam that obstructed the natural lines of drainage, and may have maintained a high surface level in the water-basin which succeeded it." Since then† this theory has been more fully stated; and Newberry, Gilbert and others, have accepted it, first as a working hypothesis and later as a well-established explanation.

By the subsequent work of a number of writers a very large body of fact has been obtained. Chamberlin,‡ describing the beaches of Lake Michigan, states that they are due to fresh water lakes, caused by land movement, the proof of this being the lack of uniformity in the level of the beach ridges.

Claypole§ accepts the ice dam theory and states his views concerning the mode of retreat of the ice cap and the resulting lakes. Dryer‖ describes in detail some of the beaches in Indiana, and Lawson** makes a very complete statement concerning the beaches along the northern shore of Lake Superior. He questions the glacial dam theory and calls for warping to account for the changes in outlet which have caused variations in level.

Spencer, one of the pioneers in the study of the Great Lakes, has gathered a large body of fact and added a great deal to our knowledge concerning the Great Lakes.†† He ascribes the former

* Geol. Survey of Ohio, 1873, I, 552.

† Geol. Survey of Ohio, II, 1874, 21–65; 72–80; Proc. New York Lyceum Nat. Hist., II, 1874, 136–138; Geol. Survey of Ohio, 1873, III, 32–51; Proc. N. Phil. Soc., 1882–3, XX, 91–95.

‡ Geol. Survey of Wisconsin, 1877, II, 219–233.

§ The Lake Age in Ohio (from Trans. Geol. Soc., Edinburgh), 1887. Edinburgh, 42 pp.

‖ Indiana Geol. Survey, 16th Rept., 1889, 98–126; Same, 17th Rept., 1892, 114–134; 160–170; Same, 18th Rept., 1894, 17–32; 72–90. Studies in Indiana Geography, Terre Haute, 1897, 42–52.

** Twentieth Rept. Minnesota Geol. Survey, 1891, 181–289.

†† See Spencer, Proc. Amer. Phil. Soc., 1880–81, XIX, 300–337; Same, 2nd Geol. Survey Pennsylvania, Rept. QQQQ, 1881, 357–406; Proc. Amer. Assoc. Adv. Sci., 1881, XXX, 131–146; Proc. Amer. Assoc. Adv. Sci., 1882, XXXI, 359–363; Amer. Journ. Sci., 1882, CXXIV, 409–416; Geol. Mag., 1887, IV, 167–173; Amer. Nat., 1887, XXI, 168–171; Proc. Amer. Assoc. Adv. Sci., 1888, XXXVII, 197–199; Science, 1888, XI, 49; Bull. Geol. Soc. Amer., 1889, I, 65–70; Trans. Roy. Soc. Canada, 1889, VII, Sect. IV, 121–134; Bull. Geol. Soc. Amer., 1889, I, 71–86; Quart. Journ. Geol. Soc., XLVI, 1890, 523–533; Amer. Journ. Sci., 1890, CXL, 443–451; Amer. Geol., 1890, VI, 294; Amer. Journ. Sci., 1891, CXLI, 12–21; Amer. Geol., 1891, VII, 86–

high-water level to marine action, though in this view he now stands practically alone. Not only does he refer to this origin the beaches recognized distinctly by others, but high deposits of stratified drift are assigned by him to the same cause, which would imply a very extensive submergence of the land, and this is Spencer's belief. He himself, together with other workers, has shown that there has been extensive warping,* which has finally dismembered the great water bodies and formed the present Great Lakes. Many of the lake stages which Spencer has worked out, and to which he has given names, are now recognized, though in some cases the construction placed upon facts by others is different from his.

Taylor has made careful studies in the region around the shores of the various lakes, and has given us a body of fact of great importance.† From his studies he was at first led to explain the beaches as the result of marine submergence, which extended over the entire Great Lakes region into the Red River valley, and northward to Hudson Bay (Fig. 2). The upper, earlier beaches, connected with overflow channels, were thought to have been caused by glacial dams; but the strongly developed beaches lower than these, were believed to have resulted from marine submergence, while certain recent

97; Amer. Geol., 1891, VII, 266; Amer. Journ. Sci., 1891, CXLI, 201–211; Bull. Geol. Soc. Amer., 1891, II, 465–476; Geol. Mag., 1891, VIII, 262–272; Bull. Geol. Soc. Amer., 1892, III, 488–491; 491–492; 494–495; Amer. Geol., XV, 1894, 135–136; Proc. Amer. Assoc. Adv. Sci., 1894, XLIII, 237–243; Amer. Geol., 1894, XIV, 289–301; Proc. Amer. Assoc. Adv. Sci., 1894, XLIII, 244–246; Amer. Journ. Sci., 1894, CXLVIII, 455–472; Amer. Nat., 1894, XXVIII, 859; Amer. Journ. Sci., 1894, CXLVII, 207–212; Proc. Roy. Soc., 1894, LVI, 145–148; Eleventh Rept. Niagara Comm., 1895, Appendix, 126 pp. (Reprint of a number of papers); Popular Sci. Mon., 1896, XLIX, 157–172; Proc. Amer. Assoc. Adv. Sci., 1896, XLIV, 139; Amer. Geol., 1898, XXI, 110–123. Because of the brief space available, it is impossible to state Spencer's views more fully and to refer more specifically to each of his contributions.

* As has been pointed out before, this warping was early recognized; but for an excellent general statement of this subject see de Geer, Proc. Boston Soc. Nat. Hist., 1892, XXV, 454–477; Amer. Geol., 1893, XI, 22–44.

† Amer. Journ. Sci., 1892, CXLIII, 210–218; Bull. Geol. Soc. Amer., V, 1894, 620–626; Amer. Geol., 1894, XIII, 316–327; Same, XIII, 365–383; Same, XIV, 273–289; Amer. Journ. Sci., 1895, CXLIX, 69–71; Amer. Geol., 1895, XV, 24; Amer. Journ. Sci., 1895, CXLIX, 249–270; Amer. Geol., 1895, XV, 100–120; 162–179; 394; Same, 304–314; Amer. Geol., XVII, 1896, 253–257; Same, 1896, XVII, 397–400; Inland Educator, 1896, II; Studies in Indiana Geography (Dryer), Terre Haute, Ind., 1897, 90–110; Amer. Geol., 1896, XVIII, 108–120; Bull. Geol. Soc. Amer., 1897, VIII, 31–58; Amer. Journ. Sci., 1897, CLIII, 208; Amer. Geol., 1897, XIX, 392–396; Amer. Geol., 1897, XX, 65–66; 111–128; Proc. Amer. Assoc. Adv. Sci, 1897, XLVI, 201–202; Bull. Geol. Soc. Amer., 1898, IX, 59–84.

changes were ascribed to tilting of the land, of which he states proof. In 1896, however, Taylor* announces his conversion to the glacial-dam theory, thus removing one of the two chief supporters of the hypothesis of marine origin.

Upham has added many facts to our knowledge of the postglacial history of the Great Lakes.† He has vigorously upheld the ice-

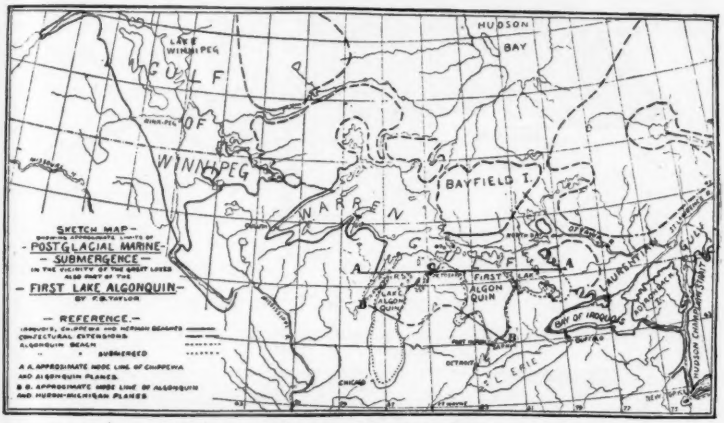

FIG. 2.—TAYLOR'S MAP SHOWING THE CONCEPTION THAT HE AT FIRST HAD CONCERNING THE SUPPOSED MARINE ORIGIN OF THE BEACHES OF THE GREAT LAKES' REGION.

dam theory, and has described the outlet of the higher Lake Superior waters, as well as the beaches around the shores of Lake Superior and elsewhere. He has also stated fully his interpretation of the succession of events connected with the withdrawal of the ice sheet from the Great Lakes' basins. Upham has also given us that classic monograph upon glacial Lake Agassiz, the most remarkable of the ice-dammed lakes.‡

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* Amer. Geol., 1896, XVII, 253–257.

† Proc. Amer. Assoc. Adv. Sci., 1883, XXXII, 230; Final Rept., Minnesota Geol. Survey, 1888, II, 642–643; Bull. Geol. Soc. Amer., 1890, I, 563–567; Same, 1891, II, 258–265; Same, III, 1892, 484–487; Twenty-second Rept., Minnesota Geol. Survey, 1894, 54–66; Nature, 1894, L, 198–199; Amer. Geol., 1894, XIV, 62–65; Proc. Rochester Acad. Sci., 1895, II, 196–198; Twenty-third Rept. Minnesota Geol. Survey, 1895, 156–193; Bull. Geol. Soc. Amer., 1895, VI, 21–27; Amer. Journ. Sci., 1895, CXLIX, 1–18; Amer. Geol., 1895, XV, 396–399; Bull. Geol. Soc. Amer., 1896, VII, 327–348; Amer. Geol., 1896, XVII, 238–241; Amer. Geol., 1896, XVIII, 169–177; Monog. XXV, U. S. Geol. Survey, 1896, 255–264; Bull. Geol. Soc. Amer., 1898, IX, 101–110.

‡ Monog. XXV, U. S. Geol. Survey, 1896. In this, references to his previous articles on Glacial Lake Agassiz can be found.

Gilbert, who gave us the first full study of a portion of the Great Lakes' beaches, has by later study contributed a great deal

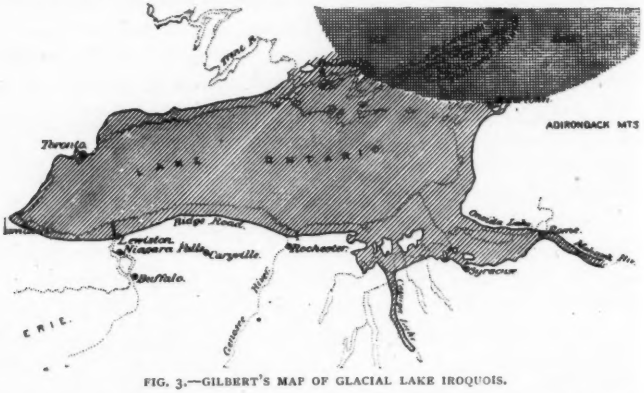

FIG. 3.—GILBERT'S MAP OF GLACIAL LAKE IROQUOIS.

to our knowledge of the eastern lakes.* He has traced the Ontario shore line in New York (Fig. 3), and pointed out its relation to the

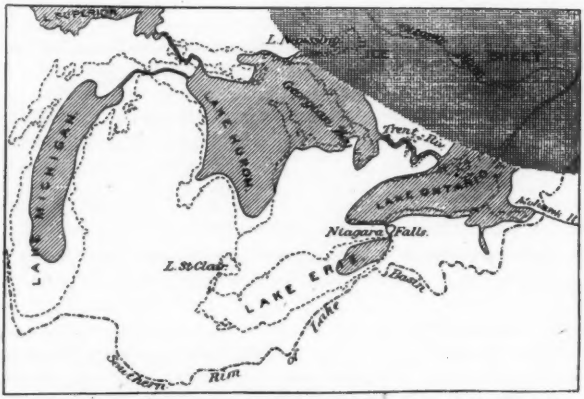

FIG. 4.—GILBERT'S MAP OF THE GREAT LAKES DURING THE TIME WHEN THE ST. LAWRENCE WAS ICE-BLOCKED.

Mohawk outflow: he has proved that the land has been tilted since the beaches were formed, and that it is probably even now

* See Science, 1885, VI, 222; Proc. Amer. Assoc. Adv. Sci., 1886, XXXV, 222–3; Science, 1886, VIII, 205; Forum, 1888, V, 417–428; Sixth Rept. Niagara Comm., 1890, 61–84; Smithsonian Rept. 1890, 231–257; Internat. Congress Geologists, 5th Session, (1891), Washington, 1893, 455–458; Bull. Geol. Soc. Amer., 1892, III, 492–493; Same, 493–4; Amer. Journ. Sci., 1895, CL. 18; Bull. Geol. Soc. Amer., 1895,

rising. Gilbert has also stated that Ontario was formerly lower than now, and that the volume of Niagara has changed as a result of the variation in outlet of the Great Lakes (Figs. 4 and 5). He has also pointed out that the Ontario shore line disappears on the northern flank of the Adirondacks, as if there had been at that place some dam, like an ice dam, which held up the lake waters (Figs. 3 and 4). He has also proved the existence of former channels in New York, caused when the waters were escaping toward the Mohawk outflow.*

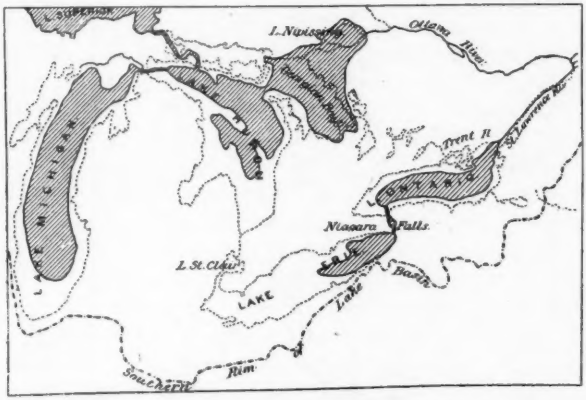

FIG. 5.—GILBERT'S MAP OF GREAT LAKES AFTER THE ICE HAD LEFT THE ST. LAWRENCE AND BEFORE THE UPPER AND LOWER LAKES WERE FINALLY CONNECTED.

Leverett† has done much painstaking work on the shore lines, especially of Erie and Michigan, and has added a great deal to the glacial dam theory by pointing out the relation between the frayed-out ends of beaches and glacial moraines. During his studies in Ohio, Gilbert had noted the disappearance of the Erie beaches toward the east, and he later proved the same thing for the Ontario shore in the Adirondack region. Suggesting to Leverett the probability of the discovery of moraines where these beaches disap-

VI, 466; Amer. Geol., 1896, XVIII, 231; Physiography of the United States, 1896, 203–236; Bull. Geol. Soc. Amer., 1897, VIII, 285–286; Nat. Geog. Mag., 1897, VIII, 233–247; Eighteenth Annual Report U. S. Geol. Survey, 1898, 595–647.

* Bull. Geol. Soc. Amer., VIII, 1897, 285–286; See also Quereau, Same, IX, 1898, 173–182 and Davis, Popular Sci. Mon., 1894, 218–29.

† Trans. Wisconsin Acad. Sci., 1889, VII, 177–192; Same, 1892, VIII, 233–240; Amer. Journ. Sci., 1892, CXLIII, 281–301; Same, 1895, CL, 1–20; Chicago Acad. Sci., (Geol. and Nat. Hist. Survey, Bull. 2) 1897, 55–86; Amer. Geol., 1898, XXI, 195–199.

peared, these were looked for and found by Leverett, and their relation to the beaches stated (Fig. 6).

In New York Fairchild* is at work on the early stages of the glacier-dammed lakes; and by his studies he has proved the existence of numerous small lakes, with southern outlets, before their waters were united to cause the larger glacial lakes described by others.†

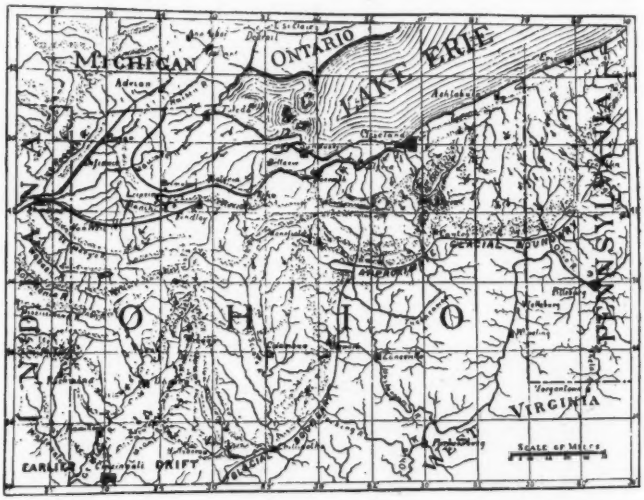

FIG. 6.—LEVERETT'S MAP OF BEACHES AND MORAINES OF OHIO.

CONSIDERATION OF THE THEORIES.—With this brief statement of the progress of ideas, and the references to the writings of the chief workers, I shall now attempt to state what seems to me to be the *most probable* post-glacial history. Here again, as in the first part of the paper, it is to be understood that I make full use of all

* Bull. Geol. Soc. Amer., 1895, VI, 353–374; Same, 462–466; Same, 1896, VII, 423–452; Same, 1897, VIII, 269–284; Same, X, 1899, 27–68.

† For other articles relating to this subject, see Claypole, Amer. Nat., 1886, XX, 856–862. Wright, Proc. Amer. Assoc. Adv. Sci., 1889, XXXVIII, 1889, 247; Bull. Geol. Soc. Amer., 1893, IV, 423–425. Davis, Amer. Geol., 1890, VI, 400; Amer. Geol., 1891, VII, 139; Popular Sci. Mon., 1894, 218–229. Bell, Bull. Geol. Soc. Amer., 1893, IV, 425–427. Hill, Amer. Geol., XIV, 1894, 405. Shaler, Bull. Geol. Soc. Amer., 1895. VI, 151–152. Mudge, Amer. Journ. Sci., 1895, CL, 442–445. Tarr, Bull. 109 Cornell Univ. Agric. Experiment Station, 1896, 90–122. Winchell, Amer. Geol., 1897, XIX, 336–339. Elftman, Amer. Geol., XXI, 1898, 101–109. Brigham, Bull. Geol. Soc. Amer., 1898, IX, 183–210. Russell, Bull. Amer. Geog. Soc., 1898, XXX, 226–254.

the literature referred to, as well as of some studies of my own, and from these draw such conclusions as appear to me to be warranted.

The raising of land barriers to the northeast, which was early suggested, is no longer held; and, if it were, it could be easily disproved, the best proof against it being the absence of beaches where the land barriers would have existed. The present lake ridges gradually disappear toward the east, as if the barrier or dam forming the lakes had also disappeared.* The mere lowering of the land barrier would not destroy the beaches that were formed against it.

Concerning the marine hypothesis, the arguments in favor of it, so far as I am able to find, are first, the supposed discovery of evidence of high shore lines, so high that ice dams could not by any possibility explain them. It is to be noted that some of these, as those in the Cayuga and Seneca valleys, are directly connected with overflow channels, as shown by Gilbert, Wright * and Fairchild, while others of the supposed marine deposits are ascribed by most glacialists to glacial origin, and not to marine action. Few geological hypotheses rest upon a more insecure basis than that of deep post-glacial submergence of northeastern America, as upheld by Spencer and others. Until much better evidence of it is brought forward, it need not seriously influence our discussion concerning the history of the Great Lakes.

A second point, proposed by Spencer,† is that an ice dam is incapable of holding back such volumes of water. Such an argument is not very strong, especially if there is good evidence that ice dams *did* hold back water bodies of large size. Most glacialists believe that a great and deep ice sheet, occupying the entire St. Lawrence valley, is a sufficiently strong dam to hold a large lake in check; and this belief is greatly strengthened by the almost certain evidence of the existence of such a dam.

A third point advanced in favor of the marine hypothesis is the fact that there *are* marine beaches in the Hudson, Lake Champlain, Ottawa and St. Lawrence valleys,‡ in which marine fossils are

* Proc. Amer. Assoc. Adv. Sci., XXXVIII, 1889, 247.

† Geol. Mag., VIII, 1891, 262–272.

‡ See Merrill, Trans. New York Acad. Sci., 1890, IX, 78–83; Amer. Journ. Sci., 1891, CXLI, 460–466. Davis, Proc. Boston Soc. Nat. Hist., 1891, XXV, 318–34. Hitchcock, Geol. of Vermont, Vol. I, 1861, 93–167. Baldwin, Amer. Geol., XIII, 170–184. Logan, Canadian Geol. Survey, 1863, 896–930. Dawson, Amer. Journ. Sci., CVIII, 1874, 143. The Canadian Ice Age, Montreal, 1894 (with references to the literature). Ells, Bull. Geol. Soc. Amer., 1898, IX, 211–222. This is by no means a complete list of references on this subject; but from these, other references may be obtained.

found. Against the correlation of these beaches with those of the Great Lakes may be argued the fact that, although the marine deposits and the lake beaches are both well developed in their respective localities, there has been no direct connection traced between them, although it has been attempted by several. No marine fossils have been discovered in the lake beaches, although such fossils abound in the marine beaches further down the St. Lawrence valley; but this absence of fossils is explained by the advocates of the marine hypothesis on the assumption that this great arm of the sea contained either fresh or brackish water, or else that the marine fossils did not have time enough to enter them from the sea.*

The existence of marine forms at present living in the Great Lakes† is also argued in favor of marine invasion; but if this proves anything, it proves merely that salt water entered the basins at one stage, which may be granted easily, without attempting to explain all the beaches by marine action. Moreover, if this marine fauna of the lakes is due to an incursion of the sea while the beaches were forming, it is rather remarkable that no remains of such a fauna have been discovered in the present beaches.‡

There seems very little in favor of the marine hypothesis, and there are numerous facts against it, and in favor of ice dams, which have never yet been satisfactorily answered. One of the strongest objections to the marine hypothesis is that the beaches end toward the east, as if the waves had worked there against some dam, like ice, which could not record their work after the ice had gone. It is true that Spencer claims that the beaches *do not* end as reported,§ and that the moraine accumulations near their ends *are not* in reality connected with them. It is too soon to pronounce a final opinion upon this latter disputed point, for naturally the ends of beaches in an ice-dammed lake will not be abrupt, but gradual, and difficult to locate definitely; and, moreover, moraines built during the recession of an ice sheet,

* Spencer, Proc. Amer. Assoc. Adv. Sci., 1882, XXXI, 359–363; Geol. Mag., VIII, 1891, 262–272; Amer. Geol., 1894, XV, 135–136.

† Hitchcock, Proc. Amer. Assoc. Adv. Sci., 1870, XIX, 175–181. Stimpson, Amer. Nat., 1870, IV, 403. Smith, Ann. Rept. U. S. Fish Comm., 1872–3, 643–644. Nicholson Ann. and Mag. Nat. Hist., Ser. IV, 1872, X, 276–285; Chamberlin in Geikie's Great Ice Age, 3d Ed. 1894, p. 769.

‡ Since this article was printed, there has appeared an important paper by Coleman (Bull. Geol. Soc. Amer., X, 1899, 165–176), in which it is announced that *fresh water* fossils have been discovered in the elevated beaches at Toronto.

§ Amer. Geol., 1890, VI, 294; Bull. Geol. Soc. Amer., 1892, III, 488–491, 494; Amer. Geol., 1898, XXI, 110–123. See Leverett's reply to last in Amer. Geol., 1898, XXI, 195–199.

while the front stood in a lake, might well fail to be formed, or else might have been formed with a very indefinite development.

With reference to the first point, it is noteworthy that in one case where Spencer has claimed to have continued the beaches beyond the supposed end, both Gilbert and Taylor,* working in the field in company with Spencer, have not been able to recognize his beaches, although pointed out by their discoverer. Gilbert and Taylor explain by other causes than wave action the deposits assumed to be beaches by Spencer. It seems fair, therefore, to hold to the belief that the beaches *do* come to an end where claimed, since all the workers in the field, excepting one, have reached this conclusion as the result of their observations; and if this conclusion is correct, then the ice-dam theory is strongly supported. Indeed, the very fact that Spencer himself admits that the connecting beaches, if they really exist, are indistinct, while elsewhere, both on the seaward and landward side, they are strongly developed, argues against the marine hypothesis.

Then, also, the overflow channels furnish an unanswered and apparently unanswerable argument against the hypothesis that the beaches were formed in arms of the sea; for it seems evident that *rivers have flowed out* through these channels from the landward toward the seaward side; and, as Davis states, it is difficult to understand how a river could flow from one arm of the sea to another. The shore lines converge toward these outlets and are strongly developed on the lake side, but have not been shown to exist on the opposite side, and in some cases are *certainly* not present there. Where, then, are the shore lines that would have been formed on the southern side of the St. Lawrence divide if the sea covered that land? Although Spencer has attempted to answer this objection of Davis', his reply does not seem satisfactory.†

Everything indicates that the former high levels of the Great Lakes were due to ice dams, as first suggested by Newberry; and the proof of this theory is so strong that opinion is now all but unanimous in favor of its acceptance. It is nearly established as a fact, though for a while should probably be considered still as a working theory. Accepting this, then, as the probable explanation, I will briefly state the history of change from the first beginning of the

* See Spencer, Bull. Geol. Soc. Amer., 1892, III, 488–491; 494. See also reply by Gilbert, Same, 492–493; also Taylor, Amer. Geol., 1897, XIX, 392–396.

† See Davis, Amer. Geol., 1890, VI, 400; Same, 1891, VII, 139. Spencer, Same, 266; Bull. Geol. Soc. Amer., 1892, III, 491–492; 495. Gilbert, Same, 493–494. Spencer, Proc. Amer. Assoc. Adv. Sci., 1896, XLIV, 139.

withdrawal of the ice sheet to the present condition of the lakes, so far as this history has been worked out, following in this chiefly the interpretations of Gilbert and Taylor.*

THE ICE-DAMMED LAKES.—During its southernmost extension the glacier covered all the basin of the Great Lakes system. As this ice sheet encroached upon the region, it must have formed numerous marginal lakes, though of these no records have yet been discovered. When the ice cap finally began to withdraw, it retreated northward and northeastward, uncovering first of all the southern portions of the drainage area. In these north-flowing stream val-

FIG. 7.—TAYLOR'S MAP OF LOCAL ICE MARGIN LAKES.

leys, tiny lakes existed, growing in size as the ice dam took successively more and more northerly positions. The map (Fig. 7) shows the approximate location of three of the largest of these lakes. Within the State of New York such lakes existed at a later time in the Champlain, Genesee, Seneca, Cayuga and other valleys.

As the ice dam melted further back, lower outflows were discovered, and the level of the lake waters fell. At the same time the small marginal lakes successively coalesced and flowed out through one outlet instead of two or more. For instance, note how, as shown in Fgures 7 and 8, the Maumee Lake has expanded to Lake Whittlesey, and, escaping across the lower Michigan peninsula

* Gilbert, Sixth Ann. Rept. Niagara Comm., 1890, 61–84; Physiography of United States, 1896, 203–236; Taylor, Studies in Indiana Geography (Dryer), Terre Haute, 1897, 90–110.

into the enlarged Lake Chicago, finds an outflow into the Illinois River past Chicago.

During the early part of this stage of coalescing marginal lakes, New York was largely under cover of the ice; but in time the same stage visited this State. At first there were numerous tiny lakes, which enlarged and coalesced, abandoning one outlet after another, until the several lakes of the Finger Lake region united into one branching lake, with an outflow over the Seneca Lake divide, forming what Fairchild proposes to call Glacial Lake Newberry. As

FIG. 8.—TAYLOR'S MAP OF THE LAKE STAGE WHEN THE EASTERN WATERS COMBINED WITH THE WESTERN AND OUTFLOWED PAST CHICAGO.

this enlarged, it is possible that the drainage finally found its way westward into the Chicago outflow, though of this there is not yet definite proof.*

Finally the ice withdrew from the Mohawk Valley, thus opening a lower outflow than that past Chicago, and then the waters of all the lakes escaped into the Atlantic through the Hudson (Figs. 4 and 9). Before this stage was reached, the water from the western lakes found its way into the Mohawk through temporary overflow channels between the ice and the land, at levels well above the Mohawk divide near Rome. Since one of the walls of this temporary river system was the ice front, it follows that the channels were not located along the natural drainage lines of the present. Thus, temporary east-flowing streams cut channels across the hills and left various other records of their existence.† It was during this stage

* See Fairchild, papers referred to on page 225.

† See Gilbert, Bull. Geol. Soc. Amer., 1897, VIII, 285–286. Quereau, Bull. Geol. Soc. Amer., 1898, IX, 173–182.

that some of the lower delta terraces which cling to the sides of the valleys of the Finger Lakes were formed, when the water in them fell to successively lower levels, as new outlets were discovered upon the retreat of the glacier.

Just before the water began to escape by this means into the Mohawk, there existed a continuous marginal lake, broadening westward, and with an outflow through the Chicago channel. This expanded lake, made by the union of Lakes Chicago, Saginaw and Whittlesey, together with other marginal waters further east, is

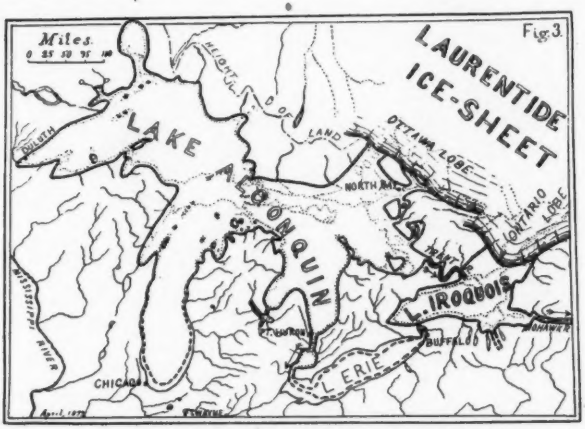

FIG. 9.—TAYLOR'S MAP SHOWING THAT STAGE IN THE LAKE HISTORY WHEN LAKE ALGONQUIN EMPTIED INTO LAKE IROQUOIS THROUGH THE TRENT RIVER (SEE ALSO FIG. 4).

known as Lake Warren. At one time it included a sheet of water parallel to the southern Erie shore, and probably also the waters that occupied the Finger Lakes region immediately after the abandonment of the Seneca divide, which had controlled the Glacial Lake Newberry. The easternmost extension of Lake Warren is not definitely known, and this connection with the Finger Lakes is merely a probability, based upon a knowledge of the fact that the waters of Lake Warren *did* extend eastward until they finally found an outflow through the Mohawk.

With the uncovering of the Mohawk, the Lake Warren waters flowed eastward, and the level fell, until, finally, the entire Erie basin was uncovered. Niagara River then began to flow when the water level in the Ontario basin fell below that of Lake Erie. The outflow of the upper Great Lakes was then, as now, through the Detroit–Lake St. Clair channel into Lake Erie; and the Niagara River was then, as

now, a large river. The three upper lakes were at that time united to form Lake Algonquin; but, as the ice front withdrew still further, it uncovered the Trent River valley, which, because of the northward depression of the land at that time, was then lower than the Detroit channel, so that the waters of Lake Algonquin were then withdrawn from the Lake Erie overflow, and the size of Niagara was greatly reduced thereby. The waters from the upper Great Lakes then flowed directly into the expanded Ontario without first passing through Erie. The expanded Ontario has been called Glacial Lake Iroquois (Figs. 3 and 9), and its overflow was through the Mohawk, because the St. Lawrence outflow was still ice-filled.

It will be noticed on the map (Fig. 9) that the shore lines of Lake Algonquin, in the Michigan region, disappear below the lake waters north of Chicago, and also that the outflow of the upper Great Lakes is marked as being through the Trent River, although we know that this is now higher than the Detroit outlet, which was abandoned in favor of the Trent. The proof of this change is found in the convergence of the beaches toward the Trent River and the evidence that a large river formerly occupied it. The tilting of the beaches is in harmony with all the other evidence, and it seems that an uplift of the land was in progress during the time of the retreat of the ice.

All the beaches of the lakes are somewhat tilted, although the oldest are most affected. This tilting, which on the Iroquois beaches of New York is about five feet per mile in a northeasterly direction, has elevated many beaches high above the level of the present lakes. One passes upgrade in going along these shore-line deposits in a northeasterly direction. That this uplift was in progress while the lakes existed is shown by the difference in inclination of the older and younger shore lines.

The uplift seems also to have shifted the outflow of Lake Algonquin once more to the Detroit Channel, thus causing the Trent River to be abandoned and Niagara River to become enlarged once more.

Finally the ice withdrew from the St. Lawrence valley, so that the level of Lake Iroquois fell, but not to the present level of the Thousand Island outflow, for the valleys of the St. Lawrence, Hudson, Lake Champlain, Ottawa, and probably also Lake Ontario, were then occupied by the sea, because of the northeasterly depression of the land. The proof of this depression comes from the discovery of marine beaches with marine fossils in the St. Lawrence, Ottawa and Champlain Valleys. While there is no direct

proof, there is some evidence in favor of extending the area of the sea beyond that indicated by Taylor, so as to admit the salt water into the Lake Superior basin.*

By the withdrawal of the glacier, the valley now occupied by the Nipissing Lake and the Mattawa and Ottawa Rivers was uncovered; and, in the depressed condition of the northern land, this was so much lower than the Detroit Channel that the volume of Niagara was again reduced to that of a small stream draining only the Lake Erie basin (Figs. 5 and 10). Taylor believes that this period, when the Nipissing Great Lakes were coalesced and had an outflow through the Ottawa into the St. Lawrence sea, was a very long one, for he finds that the Nipissing shore lines are the most

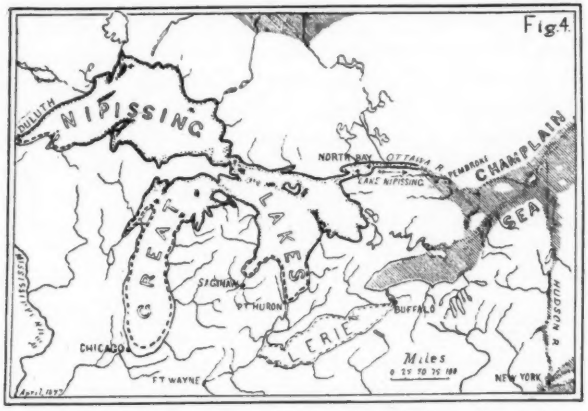

FIG. 10.—TAYLOR'S MAP OF THE GREAT LAKES DURING THE ENCROACHMENT OF THE OCEAN WATERS INTO THEIR BASIN.

strongly developed of the elevated beaches. During this stage Ontario was occupied by an arm of the sea, Erie by a small lake in its eastern end, because of the tilting of the basin toward the northeast, and the three upper lakes by a single lake, united by the same channels as at present, only slightly larger and deeper, as were the lakes themselves in the northern part. Because of the depression of the land, the southeastern ends of the Nipissing Lakes were lower than the present lake surfaces, and the northern and eastern portions higher. These points, as well as the others mentioned, have been more or less well established by the careful and detailed study of the beaches, mainly carried on by Taylor, as described in the articles referred to above (p. 221).

* See references, p. 227.

The land continued to rise, lifting the Ontario basin above the sea, and establishing the Thousand Island overflow. At first, owing to the depressed condition of the land in the eastern portion, Lake Ontario did not reach as far westward as now, and the Niagara River flowed for several miles over land now covered by the lake water. The proof of this is found in the existence of a submerged continuation of the Niagara River channel over the lake bottom, and a delta off the mouth of the present river. For the same reason, as has been stated, Lake Erie was smaller than now, and confined to the eastern end; but, as the land was elevated, the lakes assumed more and more nearly their present form, and during the progress of this uplift, the outflow was once more shifted to the Detroit channel, because the Nipissing outflow was elevated higher than the present outflow of the upper lakes. This channel has since then been continually occupied, and Niagara has since then had approximately its present volume. If the uplift is still in progress, as suggested by Spencer,* and as Gilbert has attempted to demonstrate,† there may in the future be still another change in direction of the Great Lakes' outflow, this time past Chicago. The evidence of the numerous and often tremendous past changes, which is so clear, should offset skepticism concerning the possibility of still other future changes. The land is unstable, and the future has many changes in store, and perhaps the disappearance of Niagara may be one of these.

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* See references on p. 220.

† Nat. Geog. Mag., 1897, VIII, 233–247; Eighteenth Annual Report U. S. Geol. Survey, 1898, 595–647.

THE DEVELOPMENT OF THE HANSE TOWNS IN RELATION TO THEIR GEOGRAPHICAL ENVIRONMENT.

BY

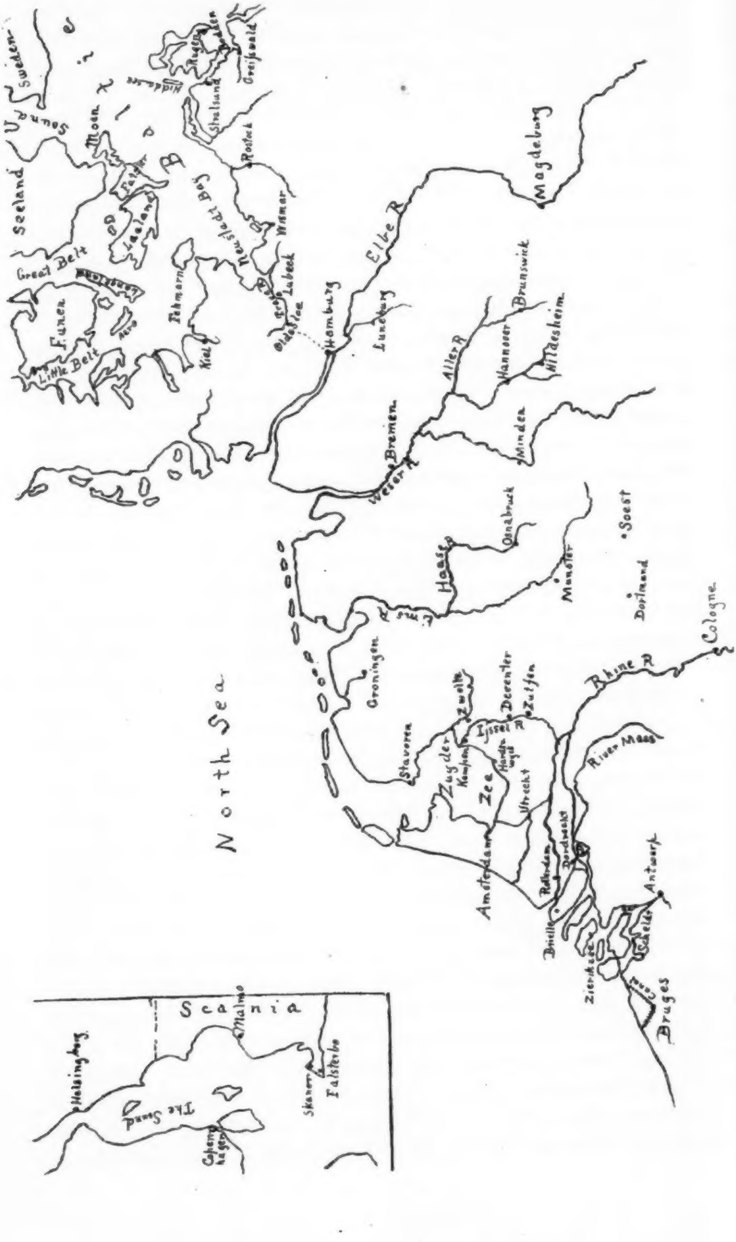
ELLEN C. SEMPLE.

Inclosed sea-basins have always been the nurseries of maritime trade and of naval power. The more land-locked the body of water, the more indented its coast, and the more numerous its islands, the more favorable are the conditions for an early maritime development. The eastern basin of the Mediterranean offered such conditions in an ideal form; soon after the dawn of history it had developed a race of seamen in the Phœnicians, whose trading vessels took the sea for their highway and the coasts for their markets. From them the Greeks learned the higher principles of the art of navigation, and soon rivaled their teachers, driving them out of the eastern Mediterranean into the less hospitable western basin. Here ports were fewer, inlets rarer, islands more sparsely scattered; but the less favorable conditions served as a spur to Phœnician seamanship. It developed; but the commercial supremacy it secured was destined to be overthrown by the rising maritime power of the Romans. This nation soon grasped the sea-sovereignty of the whole Mediterranean, because not satisfied like their Punic neighbors, with a narrow foothold here and there on the margin of the continent, they first acquired a broad, solid territorial base from which to operate in commerce and conquest. The Roman Empire died, but its most desirable heritage fell to Genoa, Pisa, and Venice. The Italian cities, by their merchant marines, became the most potent factors in Mediterranean history. A capacious, protected harbor, a happy situation at the meeting point of a great continental land route and of a sea route, the instinct of the trader and the seaman,—these were the elements which brought Venice and Genoa to the sovereignty of that sea.

While the Crusades were stimulating to the fullest the maritime development of the Mediterranean cities, there appeared in the north the small beginnings of a sea power which was destined to influence profoundly all the lands contiguous to the Baltic. Already the steady current of trade, moving down the Rhine with little interruption since the time of the Romans, had given rise to the flourishing commercial cities of the Netherlands and north-

western Germany; and it had especially developed the maritime strength of Holland and Flanders, whence the wares coming northward by the Rhine trade, or around by sea from the Mediterranean, were exported to England. The Dutch became the sea power of the north. The early and rapid development of city life from Hamburg to Bruges soon raised this whole region to the industrial centre of Northern Europe, which began then to seek with indomitable energy new markets for its manufactured products among the less progressive people in the vast lands to the east and northeast. There already existed, as early as the tenth century, a well-established commercial route northeastward from Cologne through Westphalia and Saxony, *via* Soest, Brunswick and Magdeburg to the traditional town of Vineta at the mouth of the Oder, whence an active trade was carried on with Kief and Constantinople. But this was a land route,—slow, costly, dangerous and susceptible of little development. Rapid commercial expansion could come only by sea, and, in consequence of the condition of navigation in the Middle Ages, required middlemen. A movement in the national life of the Germans at this time supplied the want, because it led to the establishment, along the whole southern coast of the Baltic, of those commercial settlements which came to be famous in history as the leading spirits of the Hanseatic League.

In the middle of the twelfth century there began an energetic and systematic effort on the part of the Germans to regain the country east of the Elbe, which had been wrested from them by the encroachments of the Slavs. The movement started from every point along the length of the boundary stream, but it was particularly well conducted under Henry the Lion of Saxony, who extended his sway over the Slavonic tribes in Mecklenburg and Pomerania. The native population was killed or driven out, and replaced by colonists from Westphalia, and especially from the Netherlands. Along the coast there sprang up cities like Lübeck, Wismar, Rostock, Stralsund, Greifswald, Wolgast, Stettin and Colberg in the course of the twelfth and thirteenth centuries. The religious motive also, aroused by the Crusades, was active to some degree in this colonizing movement; but, in the conquests of the Teutonic Knights, it was the dominant actuating impulse. The Order won to German civilization and to Christianity all the country of East Prussia between the Vistula and Niemen. The cities of Danzig, Dirschau, Culm, Thorn, Elbing, Königsberg, Memel, and others arose under the influence of the active traders from Bremen and Lübeck, and the protection of the Teutonic Order.



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But the movement, once started, spread with surprising rapidity, reaching the eastern extremity of the Baltic a few decades after the founding of Lübeck. The establishment of so many successful colonies reacted immediately upon the home conditions out of which the expansion grew, and stimulated there the commercial spirit which set out to find even the remotest markets. It made a peaceful invasion of Russia. Riga, founded in 1158 by a few Bremen merchants as a store house at the mouth of the Düna, soon passed into the hands of the Teutonic Knights, who conquered also Dorpat and Revel, evidently at the instigation of German traders, who had located in both places. There had been a trading settlement of Germans at Novgorod as early as the eleventh century; but it was stimulated to greater activity and secured special privileges in dealing with the province the latter part of the thirteenth century, doubtless owing to the development of German commerce throughout the Baltic provinces of Russia. About the same time, or soon afterwards, we find Germans established at Pskof, Ladoga, Narva, at all the outlets of the Novgorodian lakes, where the trade from the interior had to pass.

When German expansion was confined to the interior of the country, as it was in the beginning of the movement, the advance was slow,—a stubborn though energetic protrusion of the eastern frontier; but when it struck the sea, it went forward with strides and bounds, leaving in between great gaps of unsecured territory, aiming with singleness of purpose to wrap in its embrace all the desirable coast of the Baltic. A glance at the map of Germany shows the intimate connection between the presence of the sea and the course in which the race poured itself along to the east in those days: the erratic northeastern frontier, the long arm of East Prussia stretching up towards the Gulf of Riga, is no accident. There are finger-prints of the hand, moreover, left all over Livland even to-day in the scattered groups of German population there. Expansion by water is much safer and simpler than by land, communication with the home region is cheaper and quicker. Every large colonizing movement has at bottom a predominating economic motive; for this reason the young settlements must keep up their connection with the mother country, in the trade with whom lies their chief hope of wealth and growth. The southern coast of the Baltic, along which the Germans spread, offered most desirable sites for commercial colonies, combining excellent harbors with generous facilities for trade with the interior and over a narrow sea with other lands. No wonder then that many of these cities

attained a size and importance which they did not surpass for four or five hundred years afterwards, but which, in the fourteenth and fifteenth centuries, made the glory and the strength of the Hanseatic League.

The body of water which these early German traders took as their natural field of activity, is a land-locked sea in the northwestern part of Europe, connected with the open ocean only by the three narrow straits dividing the islands of Fünen and Seeland from each other, and from the adjacent peninsulas of Sweden and Jutland. It is a long crescent-shaped basin, attaining at no point a considerable width. In the southwestern portion it appears more contracted than it really is, owing to the crowding together of the Danish Isles and the fragments of land like Fehmarn and Rügen, cut off from the German coast. Just where the sea begins to broaden, between Pomerania and southern Sweden, the island of Bornholm serves as a half-way station for vessels plying between the two coasts. In the same way, further north at a still wider point, Gotland breaks midway the long stretch from shore to shore; while the numerous islands, large and small, off the coast of Sweden and Esthonia make easy the transition to the open ocean. These frequent stopping-places were of incalculable advantage to seamen in an age when navigation was far from being a developed art. Not less so were the numerous bays, gulfs, fiords, sounds, *Bodden*,* and *Haffe* of the much indented coast of the whole Baltic basin. There were plenty of harbors to put into in stormy weather, and, better still, to trade in when the promise of business was good. Furthermore, the estuaries of the German coast and the fiords of Sweden took the ship of the merchant well back from the coast; while the larger inlets, the Gulf of Riga and the Gulf of Finland, afforded waterways into the very heart of the most progressive part of Russia, and made that region one of the most active quarters of the Baltic trade.

In consequence of the long, gradual northward slope of Europe from the continental highland in the south and the land-swell which forms the watershed of Russia, the Baltic is the drainage basin of a large part of the continent, and therefore receives a great number of rivers. These are navigable for a long distance inland, owing to their gentle current; even the smallest were available for the light-draught craft of the Middle Ages in opening up the country to trade, while the longer ones made connection over mountain

* Irregularly ramifying bays with rounded contours, separated from the sea by islands, peninsulas, or lines of dunes.—(RATZEL.)

passes or lower watersheds with the head waters of the Mediterranean rivers and brought the commerce of the south and far east into the Baltic sphere of attraction. This is the explanation of the fact that even such remote cities as Breslau and Cracow, the emporiums of the upper Oder and Vistula, were eventually drawn into the commercial league of the coast towns.

The German colonial cities took up the best strip of the Baltic coast in their expansion from Kiel to Revel and Narva. Here were the most numerous inlets and ports, the deepest estuaries, the longest rivers, and a back country rich in all the resources of forest, field and mine, resources which had never been developed and which needed only the demand of trade for their active exploitation. More than this, these commercial cities occupied a geographical position intermediate between the advanced industrial centres of Flanders, the Netherlands, and western Germany on the one hand, and the undeveloped lands to the southeast, east and north on the other. Manufactured articles and the rich wares of the Rhine trade could be exchanged for the raw products of Scandinavia, Russia and Poland; and for this trade the German cities of the Baltic were the natural middlemen. Nor was this their final advantage: they belonged to a race that was superior to their Scandinavian and Slavonic neighbors, in whom therefore they could never find dangerous competitors. They had been settled in large part by colonists brought from Holland and Westphalia, the two sections which had been earliest in developing the trade of western Germany; and hence they were adapted in a peculiar way to become the commercial and maritime conquerors of the Baltic.

The German coast cities and trading settlements in the Baltic owed their early development not only to their situation along the great sea route of northern Europe, but also to the fact that the whole country to the south of them was a vast passway from the Mediterranean, and also from the Black and Caspian Seas. They formed the northern termini of the routes of trade traversing this country, and they thrived or declined according to the commercial activity along these great continental highways. They entered into close relations with the inland cities which grew up along these routes to supplement the work of the coast towns, and formed with them city systems, in which each sustained a definite relation to the others, but in which the coast town invariably held the dominant place. For this reason, we shall find that the Hanseatic League, obscure as its origin is, was formed first by a federation of maritime cities for purposes of protection to their common trade

on the sea, but that it rapidly drew into its union all the considerable towns of the interior from Holland to Livland, yielding to these inland members, however, only limited privileges.

The Russian trade-routes were perhaps the most vital arteries of the Baltic commerce of the Middle Ages. They utilized the great rivers of the country which rise near the eastern border of the Baltic, and are separated from it only by low watersheds, which

Eastern Routes of Trade

SCALE 1:15,000,000

in their turn can be reached by excellent waterways of rivers and lakes from the sea. Previous to the thirteenth century, the journey into Russia was made chiefly by water, through the Gulf of Finland and the Neva River into Lake Ladoga, thence southward by the Volkhof to Novgorod; but after the wars of Sweden with Denmark and Russia had made this route dangerous, and after the Teutonic

Knights had extended their sovereignty over Curland, Livland and Esthonia, as far as Lake Peipus, land roads came to be used more to reach the centres of Russian trade. The merchant went overland from Narva to Novgorod; or from Revel and Pernow to Dorpat, thence by the River Embach to Lake Peipus, and thence to Pskof, the sister republic of Novgorod, on the navigable Velikaya; or he disembarked his goods at Riga and carried them across country to Pskof or farther on east to Novgorod. Pskof had been a commercial settlement from the very earliest times, because the Velikaya had been a channel for the trade with the south from remote antiquity, and in the thirteenth century it became an important station for the trade between Riga and Novgorod. In the next century it became a member of the Hanseatic League. But a more important point was Novgorod. Under the stimulus of German trade this town rose to be the most renowned emporium of northeast Europe. The merchants sought it because of its commanding commercial situation. Its trade extended by way of the Volkhof and the Volga to the Caspian Sea and tne Orient; and southward down the Dnieper to the Black Sea and Constantinople. These commercial connections had existed from the earliest history of the city, and many of its political disturbances were due to the conflicting economic interests of those of its citizens who were engaged in the trade with the far east, and those who had established commercial relations with Constantinople and Greece. The former wished the alliance of their eastern neighbors, the princes of Suzdal, who commanded the Volga route; and the latter that of the princes of Kief, who controlled the road to the south. Under Hanseatic influence Novgorod became a German market, and the merchants secured the practical monopoly of trade throughout the province.

The commerce of the Dnieper was accessible to the German merchant also from Riga by way of the Düna as far as Vitebsk, and thence by a short road to Smolensk on the upper Dnieper. Even so small a stream as the Niemen was utilized for the trade of its immediate vicinity. Products were brought into Kowno, the head of navigation, carried thence down the river to the Kurisches Haff, and there absorbed in the great Baltic commerce.

During the Middle Ages there seems to have been very little direct commercial intercourse between North and South Germany except in the Rhine district, where the wines of the south country attracted the merchants of Lübeck and Hamburg; for the rest, the two sections had few products to exchange. The great commercial

roads passing through Germany, therefore, forwarded products coming from beyond the confines of the Empire. One route followed the Vistula southward along the northern slopes of the Carpathians, over the watershed to the head streams of the Dniester, and then went down this river to the Black Sea. Austrian and Hungarian products were brought out by this route; especially the yew tree from Austria, which was used for the English crossbow, was transported in great quantities down the Vistula to Danzig. This city rose to splendor through its English trade. Another route led northward from the Danube along the March to where this river approaches the headwaters of the Oder, then down the Oder to Stettin and the Baltic. But the great commercial thoroughfare of Germany was the Rhine. The roads over the Alpine passes, the St. Gothard, St. Bernard, Splügen, and Brenner, followed the Rhine valley to Constance and Basel, then went down the river, receiving important tributary streams of trade from the Main and Moselle, and ended at the Dutch cities on the various mouths of the Rhine. Some of the trade over the Brenner, however, passed directly northward *via* Ratisbon, Nuremberg, and Erfurt to Magdeburg and Hamburg on the Elbe, or to Lüneburg, Brunswick, and Bremen. Magdeburg and Brunswick were also on a line of trade between North Germany and Bohemia; hence they early formed two of the most important inland members of the Hanseatic League.

From this survey of the commercial highways of northern Europe, the fact becomes evident that they fall into two groups where greatest activity reigns,—an eastern one, reaching from the Vistula to Lake Ladoga and bringing its raw products to the Baltic; and a western one from the Elbe to the Rhine and the Scheldt, depositing its manufactured commodities on the shore of the North Sea. Between these two areas of crude production and skilled industry, we find stretched along the coast of the Baltic the long line of middlemen cities, Kiel, Lübeck, Wismar, Rostock, Stralsund, Greifswald, Anclam, Stettin, and Colberg, known in history as the Wend cities and as the *civitates maritimæ*. Between the great western emporium Bruges and the eastern one Novgorod, along the highway of the Baltic, moved hundreds of ships yearly, engaged in a trade that formed the chief source of wealth for these German cities. Russia was their largest, most remunerative market. Here they could buy cheap and sell high, for they acquired a monopoly. They brought hither silks, linen, and cloth from the looms of Flanders, Germany and England, metal wares, beer, and other products of city industry, and exchanged these for furs in large

quantities, leather, skins, and tallow. The Russian forests yielded them wax, which was so much in demand for the candles used in the church rites in the Middle Ages. The same exchanges were made, though on a smaller scale, in Finland and the neighboring coast of Sweden; but the latter country furnished in addition copper and crude iron, and the products of her northern forests, such as lumber, potash, pitch, and tar.

The value of this quarter for trade had been known even in the heathen days, and it was that which had so early attracted hither permanent German settlements when the Empire was just beginning to acquire a foothold on the Baltic. At a time when small vessels and the lack of the compass restricted seamen to short voyages, the island of Gotland was a natural halting-place for all ships bound for this northern market, whether to Stockholm, Abo on the Finnish coast, Novgorod, or Riga. For this reason it early became a distributing point for the northern trade, and remained such even after the Wend cities had organized the commerce of the Baltic. Its capital, Wisby, became a great emporium and the wealth of its citizens fabulous. In addition to its permanent German burghers, it had a floating population of German traders, representing at least thirty cities from Cologne to Revel, who for mutual protection formed there a union or confederation known as the *Gotland Genossenschaft*. This is the oldest and most important union of its kind. Furthermore, it was a powerful agent, by its retroactionary influence upon the home towns, in bringing them to form the union which was known as the Hanseatic League. The law of the *Gotland Genossenschaft* was given to the new German town of Riga and the factory of the traders in Novgorod; and the Wisby code of maritime laws was for a long time the highest authority among the seamen of the Baltic. The dues of the association, together with all extra money from the factory in Novgorod, were kept in a church at Wisby, and four aldermen, one each from Wisby, Lübeck, Soest, and Dortmund, had keys to the treasure. Afterwards, when the Hanseatic League succeeded the *Gotland Genossenschaft*, the money went to Lübeck. Though Gotland was a political dependency of Sweden, the Germans, by their energy and numbers, dominated the island. The city council of Wisby had to be composed of "people of both tongues," Gotlanders and Germans. The control of a point commanding the trade of Russia and Sweden was thus reserved to those most interested in the protection and increase of that trade.

The Germans attained ascendancy also on the mainland of

Sweden. They secured the right to nominate some of the principal magistrates in most of the maritime towns of importance, and to fill half the places in the city councils with Germans. They had no factories in the country, but under the circumstances hardly required any. Stockholm came to be regarded as a Hanse town, and Calmar put in an application to be admitted to the League. Trade with Sweden fell gradually into the hands of the Wend cities exclusively, as was to be expected from their geographical position in relation to the northern peninsula. For the same reason these were the chief cities participating in the Danish trade; they secured common privileges for their merchants as early as the middle of the thirteenth century. Agriculture was the predominant occupation of the Danes. There were no cities worthy the name in the country, and no city industries. The German merchants, therefore, furnished the people with everything beyond the commonest necessaries of life; even the retail trade fell into the hands of the German pedler who penetrated into the rural districts. The kingdom of Denmark was not large, its population neither dense nor rich, for the people had been impoverished by the long wars carried on by their ambitious monarchs and by the never-ending struggles between nobles and kings. Nevertheless Denmark drew the German traders like a powerful magnet. The attraction was the herring fisheries.

Scania, the southwestern portion of the present land of Sweden bordering on the Sound, was till 1658 almost exclusively the property of Denmark. Its value to that kingdom lay chiefly in the control of the Sound, but its importance in the commercial history of the Baltic rested upon its herring fisheries. The herring came in shoals every summer and autumn to the shores of Scania, in smaller quantities to Rügen and the coast of Pomerania. When all Europe was Roman or Greek Catholic, and consequently the numerous fast days occasioned a heavy demand for fish, catching and salting herring was a great industry. In the late summer of every year fishermen of various nationalities, though chiefly German, gathered on the coasts of Scania. A Lübeck record of the sixteenth century says that in one season 7,500 fishing boats were present in its waters. From July 25th, till September 29th, greatest activity reigned, for numerous traders and artisans followed the crowd of fishermen. As the Germans and Danes salted their fish on the ground, there sprang up a regular trade in salt, which was brought *via* Lübeck from Lüneburg, the chief source of the supply along the Baltic, and also from Colberg. The demand for barrels was enormous, so

the cooper industry flourished. The barrels were made in the northwestern cities of Germany, but were exported to Scania in the form of loose staves and bands, and then set up when they reached the market. To protect the industry in the home cities, no new barrels were permitted to be made nor old ones to be repaired on the fishing grounds. Beer was imported in vast quantities for the thirsty multitude of workmen. At those times the Scanian towns, Skanör, Falsterbo, and Malmö were busy markets for the traders and pedlers who came with their various wares.

Customs on the goods imported and taxes on the fish caught were paid to the Danish king, and formed one of his most important revenues; while the just regulation of the same was repeatedly the subject of treaties between the Danish monarch and the Hanse towns. As the result of a successful war with Waldemar of Denmark, the League gained possession of Scania in 1368. That year the Hanse records show that 34,000 tons of fish were taxed, the following year 33,000 tons. The most active part in these fisheries was taken by the Wend cities, though English, Flemish, Walloon and German fishermen from the North Sea shared in the catch. When the season was over, the fish was carried by the traders to all the markets of northern Europe.

There were also excellent fishing-grounds off the Norwegian coast north of Bergen which, together with the advantages for trade, attracted the German merchants to the western half of the Scandinavian peninsula. The country was inhabited by a simple, but rough and wild population. It was difficult to get trading privileges, harder still to hold them, and the dangers threatening the merchant were numerous. Nevertheless, there was large profit in the exchange of southern products, such as grain, beer, wine, and manufactured goods, for the raw products of the country. The Hanseatic League had its factories at Tönsberg and Opslo on the Christiania Fiord, and a more important one at Bergen, which as early as the eleventh century was one of the most active trading centres of western Norway. But here the German merchants came into sharp competition with English and Scotch traders, especially after the industrial development of England which began in the reign of Edward III.

England's commerce with the German cities passed through two successive phases. Before the development above referred to, England had only raw products to offer for exchange, and trade was in the hands of German merchants, who therefore reaped the greater share of the profit. These merchants at this period came

from Cologne, Bremen, the Westphalian towns, and some of the Dutch and Flemish cities. Their ships carried to England Rhine wines, silk, silken garments, and fine cloth, bringing away cheese, hides, and especially wool, which went to supply the Flemish looms. Cologne enjoyed a pre-eminence in this trade, and as early as the middle of the twelfth century had its guildhall and *Hanse*, or union of merchants, in London. In the early part of the thirteenth century, however, a change begins. In 1226 there is mention of Lübeck merchants in England, and, indeed, in connection with unjust taxes and abuse which they have suffered there at the hands of their colleagues from the North Sea cities. The latter felt that the Lübeckers were poaching on their preserves, but they could not help themselves, for we soon find that the energetic leader of the Wend cities has broken the monopoly of Cologne and her followers. In 1237 the English King grants freedom of trade in his country to the "Merchants of Gotland", meaning thereby the German merchants of Gotland. Thirty years later Lübeck secures the right to establish its own *Hanse* or union in London, and its traders visit the markets of Boston and Lynn. The result is, that England is open as a market to the merchants of the Baltic, and the interests of the two sections become merged. In 1260 we hear of the "guildhall of the Germans", and a little later of the *Hanse Allemaniens*, showing that the merchants had united in London as at Wisby. The Germans were the chief exporters of English cloth after the British had learned the art of weaving from their Flemish neighbors; in fact, they nearly monopolized the commercial operations of the country.

Though the North Sea and the Baltic cities were rivals in the English trade, in all other commerce there was co-operation, because the Baltic merchants were the natural middlemen for the western commodities. For this reason, it was imperative that the intercourse between the two sections should be uninterrupted. There were two routes of communication, one by water, the other by land. For people so accustomed to a sea-faring life as were the dwellers in the North German and Netherland cities, the most natural route was that which led through the Danish waters, through the Sound, the Great Belt, and the Little Belt. Always cheaper, water transportation was moreover in that day more expeditious and safer, in spite of the dangers which assailed the trading vessel. The products which found their way from the eastern Baltic to the North Sea were in general of large bulk and relatively small value, such as grain, fish, lumber and ores; they could not therefore stand

the heavy cost of wagon transportation over poor roads across the neck of the Jutland Peninsula and the double transfer to and from ships.

The voyage through the Sound, however, was anything but safe Denmark, by her possession of Scania, and at times of the fortified town of Helsingborg on the Swedish coast, commanded the passage and was not slow to take advantage of her position, which, by its strategic value, seemed to promise her supremacy in the Baltic. She was therefore able to lay a heavy hand on German trade, until the Hanseatic League made good the rights of the merchants. The iniquitous *Strandrecht*, the right of appropriating stranded goods from wrecked vessels, held in Denmark as elsewhere on the Baltic littoral, though the cities had secured the promise of exemption therefrom by treaty with the Danish kings. Their experience was, however, that when the cargo of a lost vessel was washed ashore in Denmark, it was confiscated, and there was no redress. Those early sea captains, sailing without compass or map, were forced to hug the shore for fear of losing their way, thus increasing the danger of being stranded or wrecked. Moreover, pirates abounded; many of these gentlemen when at home were lords of the castles along the coast of Denmark and western Sweden. But this danger threatened everywhere on the Baltic. In 1259 the cities of Lübeck, Rostock and Wismar formed a union against the land and sea robbers, and invited the neighboring towns to lend them assistance in the good work. A little later, in 1280, Lübeck made an alliance with the Germans of Wisby for ten years, to preserve peace and security on the sea from the Sound to Novgorod. In 1290 the five leading Wend cities, Lübeck, Rostock, Wismar, Stralsund and Greifswald entered into an offensive and defensive alliance. These are the names which appear again and again in the leagues of the next century also; for upon the Wend cities, situated as they were just opposite the three Danish channels, fell the duty of keeping open the sea route to the German ocean.

If the possible dangers arising from *Strandrecht* or the attacks of the Danes deterred the trader from the voyage through the Sound, he had recourse to the land route between Lübeck and Hamburg, especially if his merchandise were costly and could stand the more expensive transportation. The road was not long, for the Baltic through Neustadt Bay and the broad open mouth of the River Trave penetrates to within thirty-two miles of the Elbe. The termini of this highway were the two flourishing towns of Hamburg and Lübeck. They owed their importance to the fact that they

flanked the neck of the Jutland peninsula at its narrowest part, and each at the same time occupied the point of convergence of two great sea routes, while presiding over a natural thoroughfare. But land travel was hard and slow. Very scant attention was paid to constructing or repairing roads and bridges. To balance *Strandrecht* on the sea, on the land there was *Grundruhr*, which entitled the lord of the territory to appropriate any merchandise which might through accident fall to the ground within his boundaries. He had, therefore, every motive for keeping his roads in the worst condition possible. Furthermore, every few miles taxes in the form of tolls were levied. Land pirates also abounded, and the caravan had to move with an armed escort.

It was to the interest of the two emporiums, Lübeck and Hamburg, that the road between the Trave and Elbe should be freed, if possible, from danger and obstructions. Therefore, in 1241, the two cities formed a union for the protection of this highway. In 1259 they entered into negotiations for the support of a military force for the protection of traders against land and sea pirates from the Trave to the mouth of the Elbe, probably in imitation of a similar confederation which Lübeck, Rostock and Wismar had formed the same year. In 1304 a treaty in regard to their common currency contained also a clause regulating the escort to guard wares moving between the two towns, and five years later only the escort furnished by them was permitted on the road. In 1306 they entered into a union to demolish every castle within a distance of nine miles on either side of the Trave to Lübeck, and also on either side of the road leading from there *via* Oldesloe (on the upper Trave) to Hamburg. Lübeck was to bear two-thirds, Hamburg one-third of the cost; for the escort maintained, Lübeck furnished thirty-two horsemen, Hamburg, eight. It was the Wend city which was willing to make the greatest sacrifice to secure the safety of the road.

From Hamburg the main line of commerce led westward to Bruges, the great emporium of northwestern Europe, and later the chief factory of the League. The voyages from the Elbe to Flanders followed a course near the land, and could be shortened by the inside passage through the Zuyder Zee and the debouchment streams of the Rhine and Maas to Bruges and the great Dutch market Dordrecht. Naturally enough, we find most of the cities situated along this sea route, or having connection with it by river or canal, drawn into a federation whose chief object was to keep open the land and water communication with the Baltic. The list

of the Dutch Hansa was not an insignificant one; it included Groningen, Stavoren, Zwolle, Harderwyck, Deventer, Zutfen, Utrecht, Amsterdam, Brielle, Rotterdam, Dordrecht, and Zierikzee, with Kampen as the acknowledged leader of the group.

The German products of the Rhine valley which were destined for the Baltic trade, either went out down the river and followed the sea route to the east, or were forwarded to the Elbe by the land road, which was marked out by the Westphalian and Saxon members of the League,—Cologne, Dortmund, Soest, Munster, Osnabrück, Minden, Hanover, Hildesheim, Brunswick, and Magdeburg. These, like all the other inland cities of the federation, gave to it only their moral and financial support. When it was a question of furnishing men and ships to do battle for the rights or for the protection of the German merchants, only the coast cities proved themselves the active members of the League.

Out of the unions of German traders in Wisby and London, out of the federation of the Wend cities to secure the peaceful and safe navigation of the Baltic, and out of the alliance between Lübeck and Hamburg to protect the highway between the Trave and Elbe, grew the Hanseatic League; from the first of these three unions it inherited its scope, from the last two its real function. Geographical conditions made the Wend cities its promoters, and Lübeck its leader. That the League originated along the Baltic was due to the fact that this whole region was far behind the other great commercial districts of Europe in civilization, and therefore at this time presented greater risks and dangers to traders than did the Mediterranean or the North Sea. The Italian cities, for instance, never combined into an organized system for commercial ends. The Dutch towns would never have been under the necessity of uniting, as far as their trade with England and Norway was concerned; they were drawn into the Hanseatic League because of their interests in the Baltic. For the towns scattered along the German and Russian coast from the Trave to the Neva, union was a matter of life and death. Moreover, they were full of the spirit of enterprise and self-reliance engendered by their mode of life. Their inhabitants, lured as colonists to these inhospitable shores by partial exemption from taxation and by certain unusual rights and privileges as citizens, had tasted of the sweets of independence. The condition of affairs in Germany at this time was favorable to the development of free towns, for the emperor was always engaged in vain wars in Italy, trying to make good his claim for dominion there, while leaving imperial matters at home to take their own course. More than this,

the Baltic towns were situated on the newest and remotest frontier of the Empire; they were true peripheral forms, which felt very little the attraction towards the centre. Turning their backs on their own country, they faced towards the foreign lands whence came their wealth; and the dangers which threatened from the same source they relied on their own strong arms to avert. Hence on their own authority they formed a confederation, of which the Wend cities were the moving spirits. The occasion was a bold attack on the German merchants by Waldemar of Denmark in 1361. Representatives of the Wend and Prussian cities met at Greifswald to punish the offender and force from him a guarantee of safety for their trade. This confederation formed at Greifswald was regarded in Lübeck as the origin of the Hanseatic League, though in the forty years previous there had been numerous minor unions of a loose and intermittent character which embraced most of the trading towns of Germany.

Schaefer calls the region from the Elbe and Trave to the Oder the classic ground of the Hanseatic League, as the Wend cities were the most important factors in the growth of the union. They, as we have seen, were most extensively interested in the Baltic trade, in the fisheries of Scania, and therefore most deeply concerned for the preservation of land and water communication with the North Sea. From their geographical position it followed that they were the ones to hold in check the Scandinavian powers who were the greatest menace to Baltic commerce, and to represent all the League in dealing with those powers. From the northern point of Pomerania could be seen the chalk cliffs of Moen; from the Wend coast the descent upon the Danish Isles could be swift and sudden. Moreover, the means were not wanting; the large merchant marine of these *civitates maritimæ* was easily converted into a naval fleet. All that was necessary was to load the vessels with arms and men instead of merchandise. The history of the ten years' conflict of the Hanse towns with Waldemar of Denmark is the story of the rapid evolution of a commercial power into a sea power. The larger, two-mast vessels or *Koggen* were about two hundred tons burden, and could carry a hundred armed men each, besides the necessary sailors; the smaller ships or *Sniggen* were utilized as transports, despatch boats, or in shallow water as lighters. To a people who had themselves spent half their life in fighting pirates, privateering was a natural recourse in war; so letters of marque against the Danes were given to those who might wish to enter this branch of the service.

The conflict with Denmark fell into two periods, the first war from 1361–1365, the second from 1367–1370. In the latter, Waldemar had an ally in the King of Norway. Though the Greifswald Assembly of 1361 included councillors from Danzig and Culm representing the Prussian towns, the first war was carried on with no active aid from this section. The burden of the contest was borne by the Wend cities, aided in a small degree by Hamburg and Bremen, though appeals had been sent in every direction from Revel to Bruges. The Wend cities furnished a war contingent of forty-eight ships and two thousand men, Hamburg two ships and Bremen one. All that the other towns of the League did was to stop their trade with Denmark and in some cases levy a tax for the campaign.

Participation in the second war was more extensive, embracing all the leading cities from the Trave to the Neva. Hamburg refused to contribute ships or men because the League would not promise to protect the Elbe in case of an attack there. Bremen could do nothing because she had recently been weakened by some serious troubles of her own. The Netherland cities, under the able leadership of Kampen, rendered valuable aid by a terrific attack upon the coast of Norway, which they laid waste from Gota-Elf to Bergen. Lübeck had the control of the Baltic squadron. In April, 1368, the fleet assembled at the little island of Hiddensee, off the northern point of Pomerania, for the victorious descent upon the Danish Isles; on June 14th of the same year the captains of the League force declared the sea safe for trade. It is a significant fact that only the coast towns were called upon to furnish a contingent or war funds; inland towns were quite ignored, though they were to enjoy the benefits of victory. The Hanseatic seal represented the imperial double eagle, with the inscription, *Signum civitatum maritimarum.* In other words, the League was primarily, both as to origin and purpose, a confederation of coast towns, its leaders the original *civitates maritimæ.*

By the treaty of peace ending the war, the cities secured free trade for the German merchants throughout Danish possessions, regulation of the customs and re-establishment of all their former privileges in Scania; as a guarantee for the fulfilment of these terms, they were to have the most important strongholds in Scania for fifteen years, together with the revenues of the district as a war indemnity. To the modern mind this concession in regard to the castles of Scania might appear as the opening wedge for the permanent acquisition of that valuable bit of territory. But the League looked at it otherwise. At the end of a year, finding the

maintenance of the castles rather costly, it relinquished them to a Danish nobleman, the prime minister of Waldemar, who was to hand over to the cities the net proceeds from the revenues of the district for the stipulated term of years. To the Hanseatics this was a perfectly natural proceeding, for, like all purely commercial people, they had no desire for territorial expansion; they were the Phœnicians of the Baltic. While they put forth all their energy to have their trade ramify as broadly as possible, they found it expedient to keep their base contracted. Ratzel, in his recent work on the principles of political geography (*Politische Geographie*), formulates the principle involved here when he says:—

"In the founding of trading colonies no regard is paid to the acquisition of any more territory than just suffices for city and harbor. Trade does not need much land, shuns the trouble and danger of its defense. Most of the French and Italian maritime cities which had municipal colonies in the Levant never sought land, did not ask for it even when the rewards of victory were being distributed for the aid they had rendered in the Crusades."

This was the same principle which guided the Hansa. When the war with Waldemar was over, some of the neighboring princes wished to have the kingdom divided up piecemeal, but the cities interfered to prevent its partition, and the small portion they acquired themselves by the terms of the treaty they soon gave up. The policy was a short-sighted one, because it left the League too narrow a base from which to operate effectively, and too limited resources within the cities themselves in the event that their office as middlemen should ever be taken from them. And this event was inevitable. Just after their victory over Waldemar, they excluded the Flemish and English from the Baltic, and early in the sixteenth century tried to shut out the vessels of the Netherlands; but the Dutch had become sufficiently strong at sea to force the free navigation of the Baltic, and the monopoly of the League there was broken. Dutch and English vessels then traded directly with the Polish, Prussian, Russian and Swedish cities, and such of these as had been members of the League fell off from their allegiance because their interests were now at variance with those of the confederation.

The great historical event which acted as a death-blow to the sea-sovereignty of Venice contributed also to the decline of the Hanseatic League. After the discovery of the sea route to India and America, the oriental trade which had filtered through Russia to the Baltic ceased. The current of commercial activity, shifting as its nature is, flowed into new and vaster channels, leaving the

Baltic and the Mediterranean for centuries mere sluggish pools. The inclosed basin, the limited environment which had served as a nursery for an infant maritime enterprise, became the prison of the full-grown sea power. The struggle for sea-sovereignty was transferred from the smaller bodies of water to the open ocean. Commerce became the exchange of products between hemispheres. Victory and wealth fell to those nations who were advantageously situated in immediate contact with the Atlantic, and were therefore able to lay hold of the new markets in the new lands.

PHYSIOGRAPHIC NOTES.

BY

RALPH S. TARR.

SHORELINE TOPOGRAPHY.—A consideration of shorelines from the standpoint of the American school of Physiography has for some time been needed. This Dr. Gulliver has attempted in his thesis for a doctorate at Harvard, recently published in the Proceedings of the American Academy of Arts and Sciences (Vol. XXXIV, 1890, 149–258). In this paper many facts concerning shorelines in various parts of the world have been brought together under several headings. There are also references to the individual coast charts upon which the phenomena described are to be seen illustrated. There is evidence in this of long, patient and detailed study of maps; and the appended bibliography, together with the references, furnish evidence of extended study of the literature.

While the paper must be considered as an important contribution to the literature of physical geography, it is weak in the fact that it is based upon laboratory rather than field work. Naturally an investigation of the shorelines of the world for a doctor's thesis could not be based entirely upon field study; but a large measure of field work might have formed a better basis for the map study. One naturally questions conclusions about far away places studied solely from maps. The necessity for a fuller knowledge of the field is evident from the failure of the author to recognize the importance of waves in modifying shore form, and in ascribing undue power to tidal and other currents.

The paper is in harmony with much American physiography literature in the use of unusual terms and the production of new terms. This is perhaps necessary, though if so, the necessity is to be deplored. Instead of deliberately offering a new term to be used, it should be the effort of every writer to avoid the coining of terms. In this paper, for instance, we find the following words, insequent, consequent, subsequent, obsequent and sequential, referring to land forms. To be sure the author of the paper is not the originator of these; but nevertheless he uses them. Are they necessary? Are they even useful? Then there are nips, loop-bars, flying-bars, rias, ria-deltas, tombolos, betrunked rivers, offsets,

overlaps (already in use in other meanings), cycles, epicycles, and winged beheadlands, the latter being a new name for Long Branch. Soon no one but a professional specialist in a single branch of physiography would be able to read the literature intelligently if this were allowed to go on and stand. The encouraging sign is that of the hundreds of names coined for land forms in the last fifteen years, only a few have been allowed to live.

LAKE IROQUOIS.—In connection with the discussion of the history of the Great Lakes published in the present and last numbers of this Bulletin, it is interesting to call attention to a recent paper by Coleman (Bull. Geol. Soc. Amer., March, 1899, Vol. X, 165–176). A part of this paper is devoted to a more or less theoretical consideration of the interglacial predecessors of Lake Iroquois and to a statement of the evidence of warping of the shore lines; but the most important portion is that which announces the discovery of fresh-water fossils in the beaches formed during the higher levels of Ontario in the vicinity of Toronto. In addition to shed horns of caribou and wapiti, and a mammoth's tooth, numerous shells of fresh-water forms were uncovered from beaches 150–160 feet above the present level of Ontario. This is not the first instance of such finds; but the prevailing absence of fresh-water forms has been one of the weak points in the theory that these higher levels were due to ice dams, and not to that incursion of the sea which made the marine beaches of the St. Lawrence valley. Each new discovery of fresh-water fossils in the lake beaches strengthens the already nearly established ice-dam theory.

GLACIATION IN THE UPPER YUKON.—One of the directions in which investigations in glacial geology are most needed is the study of the little-known regions of British North America, Alaska and Asia. When we know just how far the glaciers of these regions extend we may have better hopes of understanding their cause. Therefore a paper like that by Tyrrell (Bull. Geol. Soc. Amer., X, April, 1899, 193–198) upon the glacial phenomena of the Yukon, although brief and general, is of importance. While the Chilcat range is glaciated to-day, during a preceding period the glaciation of the region was much more extensive; but the high mountains even then projected above the ice fields which reached only to about latitude 62°. The characteristic feature of the glaciation was, as now, the development of valley glaciers, some of them reaching a depth of 2,000 to 3,000 feet. By their deposits numerous lakes

were formed, while beyond the limits of the glaciated region no lakes were seen.

The striking fact gained from this, as from preceding studies, is that, while the glaciers of the mountains of the northwest and of Asia were formerly more extensive than now, these sections were not at any time occupied by glaciers of continental proportions comparable with the great ice fields of the Atlantic basin in northeastern America, Greenland and northwestern Europe. This is a fact of marked significance in relation to the cause of the glacial period; but just what the significance is cannot now be definitely stated.

GLACIAL EROSION.—Some years ago Dr. D. F. Lincoln, and later the writer of these notes, brought forward evidence of profound glacial erosion in the Finger Lake region of New York, by which some of the grander features of the region have been produced. Since that time evidence in the same direction has been accumulated, though not yet published, which seems to place the conclusions of the previous papers beyond question. Studying in the same general region, Dr. Gilbert (Bull. Geol. Soc. Amer., X, March, 1899, 121–130) has arrived at the conclusion that the erosive work of the glaciers has been profound. Besides announcing his support to the general conclusions reached by Dr. Lincoln and myself, he brings forward evidence of marked glacial erosion along the south shore of Lake Ontario between the Niagara and Genesee valleys. He says: "From these facts it appears that if the drift were wholly removed and the rock surface bared the topography would comprise a series of ridges and troughs running parallel to the trend of the northeasterly streams. The details of rock configuration conform to the direction of ice motion, and are evidently products of glacial erosion."

VOLCANOES OF THE ABSAROKA RANGE.—Mr. Arnold Hague's presidential address before the Geological Society of Washington (published by the Society, Washington, April, 1899, and previously published in Science, 1899, XI, 425–442) is upon the early Tertiary volcanoes of the Absaroka Range, a region on the eastern side of the Yellowstone Park. The paper tells of the many eruptions, the evidence of marked sculpturing, the formation of lakes and ponds by the lava dams, the preservation of land fossils, and the evidence from various directions of great lapse of time occupied in the extrusion of the materials. This region of extensive and long-continued

volcanic activity naturally has an interesting story to tell, and many of the points brought forward by Mr. Hague will attract more than passing interest.

The one fact of most importance to the physiographer is the definite statement that, while there are true volcanic cones in the park, as for instance Mt. Sheridan, these are later than the Absarokas, and in the Absarokas "there is nothing to indicate the characteristic slopes of a great volcano." Dr. Thoroddsen has long since pointed out the evidence from Iceland that the eruptions there are from fissures, and that often no volcano has been built around the vent; and Geikie has pointed out the same for the ancient volcanoes of the British Isles. Now Hague affirms the same for the vast area of the Absarokas, and those who have given attention to the volcanic phenomena of the west are ready for the announcement and for similar conclusions from those who may study other great volcanic districts of the west. It seems certain that while tubular vents have had their importance exaggerated, fissures have not been recognized fully.

THE SHAPE OF THE EARTH.—Gregory (Geographical Journal, 1899, XIII, 225–251), after stating the well-known facts (1) that the land is mainly in one hemisphere and the water in the other, (2) that the oceans are triangular pointing northwards, while the continents are of the same form pointing southwards, and (3) that the continents are antipodal to oceans, discusses the explanations that have been proposed to account for this symmetry, and finds them wanting. He then restates Wm. Lowthian Green's tetrahedral theory and advocates it with great force and clearness, showing that the greater earth elevations and depressions are tetrahedral in arrangement, that geological evidence supports this view of earth form, since stable sections are located at the tetrahedral "coigns" or corners and unstable positions and lines of weakness along the tetrahedral edges, and that every hard-shelled spherical body which is diminishing in size, owing to internal contraction, tends constantly to become tetrahedral in form.

The case that he makes seems a strong one, and his paper appears to be one of the most rational attempts to state the law of earth form that has appeared. He remarks, as if to their discredit, that the elementary text books still teach that the earth is an oblate spheroid, although known not to be; but it may be said that in all probability they will continue to do so, for notwithstanding the fact that the earth is slightly deformed, it is still a sphere in its general

form, and young pupils who see it represented on a globe naturally understand it as a sphere. It would be unsafe and unwise in this connection, as in others, to attempt to teach them the whole truth. A geoid or a tetrahedral figure can mean little to them, and if an attempt is made to teach them what these terms mean, they will be led farther from the truth than they would be if taught that it is a slightly distorted sphere. Even when the tetrahedral theory is more firmly established than now its consideration must be postponed beyond the elementary books.

MAP NOTICES.

BY

HENRY GANNETT.

Since the last notice the U. S. Geological Survey has issued ten additional sheets of the atlas of the United States.

The Housatonic sheet, comprised mainly in Massachusetts, with margins of Connecticut and New York, is a reduction of four adjoining sheets from the one-mile to the two-mile scale. It is interesting in the fact that it brings into one map an area of about 900 square miles, comprising a large tract of the old base-levelled region of western Massachusetts, with the broad valley which the Housatonic has cut in comparatively recent times in relatively weak rocks.

In New York are three sheets, Brockport, Hamlin and Skaneateles, all in the western part of the State. Hamlin lies upon the south shore of Lake Ontario and presents almost a level plain, only slightly diversified by regular glacial deposits. South of it lies the Brockport sheet, also with a glacial surface, which is but little more accented than that of the Hamlin sheet. Skaneateles lies farther to the east and contains Otisco, Skaneateles and Owasco lakes.

In Illinois is one sheet, Danville, upon a scale of 1:62,500, with contours at intervals of ten feet. The upland surface of this prairie country is in places so extremely level as to change less than 10 feet per mile, yet through this level upland meanders Vermilion River in a course incised some 200 feet below the general surface.

In the upper peninsula of Michigan is one sheet, Crystal Falls, upon a scale of 1:62,500, with a contour interval of 20 feet. This sheet is fairly representative of the intricate, irregular glacial topography of this region, abounding in lakes, irregular hills, marshes and crooked streams.

In South Dakota are three sheets; two of them, Northville and Redfield, are east of the Missouri River and on a scale of 1:125,000, with a contour interval of 20 feet. These represent a region of glacial deposit with little relief, and surface but slightly modified since the retreat of the glacier.

The third sheet of this State, Sturgis, is in the Black Hills and includes Deadwood and the mining district thereabouts. The scale is 1:62,500, with a contour interval of 50 feet.

In New Mexico is one sheet, Deming, in the southern part of the territory. The scale is 1:125,000, and the contour interval 100 feet. With the exception of three small mountain groups and a few isolated peaks, this sheet represents a broad level plain, with scarcely an undulation upon its surface. There is apparently not a living stream upon it, Mimbres River carrying water only during the time of melting of snows in the mountains.

Our new possessions continue to furnish an impetus to map making. The Signal Office of the War Department has republished, by photolithography, greatly reduced, a Spanish map of the Philippines, under the title "Carta General del Archipiélago Filipino, Chofre y Comp'a, Manila, 1897." The map is produced entirely in black, the relief being in hachures.

The Bureau of Military Information of the War Department has also republished a general map of the Philippines, which, in the Spanish edition, bore the title "Carta General del Archipiélago Filipino. Levantada principalmente por la Comision Hidrográfica, al mando del Capitan de navío, D. Claudio Montero y Gay, hasta el año 1870 con adiciones hasta 1875, Madrid, 1875."

In this edition the water is printed in a flat blue tint, and the land in gray tint, while the relief is expressed by crayon.

The same office has published an outline map of Puerto Rico, showing streams, roads, trails, railroads and settlements. No attempt is made to show the relief.

Les Lacs Français, par André Delebecque. Ouvrage couronné par l'Académie des Sciences. Paris. Typographie Chameraud et Renouard. 1898. Royal octavo, pp. 436, with 153 cuts and 22 plates and an atlas of 11 plates (maps).

This superb work presents the results of surveys and soundings of seventy-three of the lakes of France, including all the larger and more important ones. Of these, maps are presented, showing, either by contours or tints, the relief of the lake bottoms. Studies have been made of their inflow, outflow, level, temperature, color and transparency, sediment, and finally, the origin of these lakes.

All of these aspects are treated. The most interesting is that of their origin. M. Delebecque classifies them under the following heads, the barrier being produced by

1. Land slides.
2. Glaciers.
3. Moraines of living glaciers.

4. Moraines of extinct glaciers.
5. Lava flows.
6. Volcanoes breaking out in valleys.
7. Walls of volcanic craters.
8. River alluvium.
9. Sand-bars on the seashore.
10. Dunes.

Of all these, beautiful examples are found in the maps.

H. G.

NOTES ON ANTHROPOLOGY.

MR. LANG'S THEORY OF PRIMITIVE MONOTHEISM.—When last year Mr. Andrew Lang's book "The Making of Religion" appeared, it was a foregone conclusion that much criticism would be called forth, because of the complete round-about-face which the author had made, with respect to some of the most cherished beliefs of the modern Anthropological School. In writing this book Mr. Lang had two ends in view; first, to call attention to the fact that among many savage peoples the same phenomena occur which are being investigated by the various Societies for Psychical Research, and that we should give them the same credence that we give to such phenomena among ourselves;—and second, to prove that the savage in his lowest state was really a monotheist, that contrary to the accepted belief of anthropologists, he worshipped "a relatively supreme, moral, and benevolent Creator, unborn, undying, omniscient, and omnipresent." With the first of these questions, discussed in the first half of Mr. Lang's book, the criticisms which have appeared have had little to do, the interest having centred chiefly about the second. In "Folklore" for December, '98, Mr. E. Sidney Hartland has a long article in which he critically examines the evidence in support of his theory which Mr. Lang brings forward from Australia;—Mr. Lang replies to this in the March number of the same journal, which also contains a "Rejoinder" from Mr. Hartland. Although dealing with the single case of Australia, the discussion has brought out some important general points which are worthy of consideration.

Mr. Lang sets out by declaring that the prevalent opinion among anthropologists is that Gods have developed out of Ghosts. With this theory he cannot agree. He therefore proceeds to examine the Gods of various savage peoples, and reaches the conclusion that there are "two chief sources of Religion, (1) the belief . . . in a powerful moral, eternal, omniscient Father and Judge of men, and (2) the belief . . . in somewhat of man that survives the grave." We have long been familiar with the ideas held by savage peoples in regard to their so-called Supreme Deities, but no student has till now seriously attempted to view these in the light in which Mr. Lang does. Such deities have been considered to be the germs, but only the germs of those which later in the history of culture developed into the real Supreme Deities of the great monotheistic systems;

such a deity is described by Mr. Tylor as "An unshaped divine entity looming vast, shadowy, and calm beyond and over the material world, too benevolent or too exalted to need human worship, too huge, too remote, too indifferent, too supine, too merely existent, to concern himself with the petty race of men . . ." Mr. Lang has had access to no new materials, he has not himself gathered any new beliefs in the field; that his results differ so completely from those of other workers must therefore be due at least in part to his attitude in regard to the facts. What this attitude is, is well shown by Mr. Hartland, in discussing the Australian "High Gods."

Any one who has made even the most superficial examination of the ideas held by the Australian natives in regard to their deities, must be struck by the astonishingly monotheistic cast of the myths and beliefs of some of the tribes as reported in the various published accounts. So marked are some of the resemblances to Christian doctrine, that one is tempted to ask at once, that question which the anthropologist must ask himself continually, "Are these ideas not directly traceable to missionary or other European influence?" It is just here that Mr. Lang differs from most other investigators. He contends that there is no evidence of European influence here, and that the ideas as he finds them printed in the books are solely of native origin. Mr. Hartland devotes considerable space to an examination of this thesis, and insists that in such matters we should exercise the greatest circumspection, and consider all possible means by which the savage ideas might have been influenced and modified by Christian tradition. One of the most common, and at the same time most subtle of these means, is the unconscious modification to which savage ideas are subject in being transcribed by Europeans. Without the slightest intentional warping, without the least conscious fraud, what is to the savage merely a vague conception of a powerful being living in the clouds becomes a thoroughly definite idea of a Supreme Deity, a God, a Creator. All who have had practical experience in trying to record the beliefs of savage peoples know how difficult it often is to find words which shall exactly convey the meaning intended, and it is not surprising, therefore, that observers without careful training, or who do not realize sufficiently the great importance of the matter, should frequently make an error in their choice of terms. Mr. Hartland has in his "Rejoinder" pointed out a specific case of this unconscious tinging of savage ideas with Christian doctrine in one of Mr. Lang's authorities, and Mr. Lang himself is not exempt from the charge, in that, as Mr. Hartland says, his lavish use of capital letters and of terms like

"Our Father in Heaven" tends to convey to the mind of the reader a subtle suggestion of Christian conceptions which, by the use of fewer capitals and of words and phrases not peculiar to Christian theology, might be avoided. From the very nature of the case it is often impossible to get evidence of such unconscious modification as Mr. Hartland refers to, but his position seems well taken that Mr. Lang has not subjected his authorities to a sufficiently rigid examination in this respect, and that when such examination is made, it becomes clear that much of his evidence is worthless.

One feature of general interest and importance to which Mr. Hartland calls attention is the peculiar and rather arbitrary division, which Mr. Lang makes, of all belief into "religious" and "mythical" factors. According to this all that is rational is religious, all that is irrational is myth; and for the proving of his hypothesis of a primitive monotheism, Mr. Lang makes use only of the former. In any estimate of the religion of a people, however, both mythical and religious factors must be given each their due weight, for neither alone truthfully represents the actual belief. Moreover, in dividing all belief thus into "religious" and "mythical" factors, Mr. Lang places under the latter heading only "that multitude of obscene and humorous tales";—a division which, although very convenient for proving his point, in that it excludes all evidence of actions unbecoming a "moral Judge and Father of men," is hardly one which will recommend itself to the great body of students.

There is one assumption made by Mr. Lang which deserves more attention perhaps than it has received. He states that the generally accepted opinion among anthropologists in regard to the gods, whether or not Supreme, of savage peoples is, that they had their origin in ghosts, that from the propitiation of the souls of dead ancestors or tribal leaders the whole system of gods and goddesses took its rise. This is equivalent to saying that all anthropologists are followers of Spencer and his theories of Ancestor Worship. Certainly this is far from being the case. Since Mr. Spencer wrote his Principles of Sociology a vast amount of material has come to light which goes very strongly against his theories, and the more carefully the beliefs of savage folk are studied, the more inadequate does Ancestor Worship become as an explanation. Tiele, to name but one of the anthropologists and students of religion whose eminence none will question, in his Gifford Lectures in '96, shows the insufficiency of Spencer's theories to account for the origin of religion, and presents in a masterly manner the theory of "Naturism,"

as it has been called by Réville, one of its earlier exponents. The great mistake into which most of the builders of theories of the origin and development of religion have fallen seems to be that they seek to find some one cause, some single factor to which the whole matter might be ascribed; they fail to realize sufficiently the enormous complexity of religious belief, and the futility of attempting to find any single cause to explain it all. How complex, how confused and obscure the origin and growth of religion has been, we are, perhaps, only just beginning to see, and the wiser course would seem to be to admit that there must have been many factors which, taken all together, have been the source of man's religious beliefs. We can then see how different races, under different environments, might have combined these factors in slightly varying proportions, and how from this difference in composition, difference in religion and in religious development would result.

We are passing at present through what in the future will probably be recognized as a period of great importance in the history of Anthropology. The enormous amount of material for study and comparison which has been pouring in for the last few years, affords a body of facts already far beyond the capacity of any one man to digest. Old theories are being called in question, new ones suggested, and discussion is rife. It is a season more or less of unrest and readjustment. Mr. Lang's book comes at a time when it is sure to find many criticisms; but whatever may be the final verdict in regard to his theories, or whatever the outcome of the discussions to which it gives rise, all students must be glad of the discussion it has called forth, and will regard his modern exposition of the old theory of primitive monotheism as still another of the many debts which Anthropology owes to one of its most brilliant followers.

ROLAND B. DIXON.

NOTES ON CLIMATOLOGY.

BY

ROBERT DEC. WARD.

CAN AMERICANS BECOME ACCLIMATED IN THE PHILIPPINES?—The question as to whether or not Americans will ever be able, or will want, to live in the Philippines, when those islands are no longer the scene of warfare, is one which brings up the still larger question as to the possibility of the acclimatization of the white man in the tropics as a whole. The opinion of the great majority of those who have studied this matter most carefully is that complete acclimatization is impossible. By complete acclimatization is meant the adaptation to the new climate to such an extent that the individual and the race shall be as independent of the new climate as of the old, and that generations of children may be born under the new climatic conditions without suffering any deterioration. This, of course, does not mean that white men from Europe or North America may not *live* in the tropics, nor that all tropical countries present equal obstacles to acclimatization. In the Hawaiian Islands, for instance, Americans may live about as they have been accustomed to live at home, while on the Gold Coast of Africa no amount of care seems able to avert malaria, and when a man has once been stricken with it, the only thing for him to do is to leave the country—if he has time. It is generally agreed that the white man, if he is extremely careful as regards his food, drink, clothing, dwelling, etc., may live in most parts of the tropics, with a fair chance of good health. But, as has been well said, to *tolerate* a climate is one thing; to be *independent* of it is quite another. The English live in India; they tolerate the Indian climate, but they are not acclimated. Our leading authority on the Philippines, Professor Dean C. Worcester, comes to the same conclusion as the European students of the problem of acclimatization of the white man in the tropics. In his book, *The Philippine Islands and their People* (pp. 65–67) Professor Worcester speaks as follows:

"If one is permanently situated in a good locality, where he can secure suitable food and good drinking water; if he is scrupulously careful as to his diet, avoids excesses of all kinds, keeps out of the sun in the middle of the day, and refrains from severe and long-continued physical exertion,—he is likely to remain well, always supposing that he is fortunate enough to escape malarial infection . . . But how is it

with the explorer, the engineer, the man who would fell timber, cultivate new ground, or in some other way develop the latent resources of the country? That, as Mr. Kipling so often remarks, is another story.... It is unfortunately true that the climate of the Philippines is especially severe in its effect on white women and children. It is very doubtful, in my judgment, if many successive generations of European or American children could be reared there."

In the last two sentences we have a forecast of the future of American occupation of the Philippines. A few American men, who will be sent out to the islands as officials or as soldiers, may be able to live there, by exercising great precautions, in fairly good health. But Americans will never want to make permanent homes there for their wives and for their children. This condition of things has been well described by a gentleman who was for some years Judge of the Supreme Court of Ceylon, in the following words:

"Surely for us there is no climate like our own. And when all is said, in a tropical climate, even of the best, we live, as it were, on sufferance; and the climate tells on the next generation. For every one of us who has his livelihood to gain in Ceylon, there comes the inevitable day when he must part with his children and send them home. This stern necessity has been styled a price which we pay for our Eastern possessions, and a heavy price it is."

THE PANAMA CANAL.—Two serious problems, both directly connected with the climatic conditions on the Isthmus of Panama, confronted the original Panama Canal Company. The first of these problems concerned the floods on the Chagres River. The second concerned the health of the employés. The difficulty in the first case arose from the fact that the canal, for a considerable part of its length, follows the valley of the Chagres River, a stream which, although harmless in the dry season, is subject to sudden, and sometimes enormous freshets during the rainy season. It therefore became necessary to control this river in such a way as to prevent any possible damage that it might do to the canal during its times of flood. This important problem was never satisfactorily solved by the original Canal Company, owing to the fact that no proper preliminary surveys were made, and it has come to be generally believed that the floods of the Chagres River during the rainy season are an insuperable obstacle in the way of the construction of a canal across the Isthmus of Panama. This is by no means the case. The reorganized Panama Canal Company has, through its Commission of Engineers, completely solved the problem of controlling the Chagres. The flow of the river is to be regulated by two large artificial lakes, of such a size that they will safely store

the water from even the largest freshets. Thus a climatic difficulty presented by the heavy downpours of the rainy season on the Isthmus, has been successfully solved by the ingenuity of man. The water from the upper of the two reservoirs will be used to supply the summit level of the canal during the dry season, and will also furnish power for operating the locks and lighting the canal at night. The Chagres River is, therefore, no longer an element of danger, but, in the words of one of the engineers of the Canal Company, "is rather a useful friend, whose assistance will be of great value to the canal in its operation."

The second difficulty which presented itself to the first Panama Canal Company concerned the health of the employés. In the early days of construction, the laborers who were employed were not suited to work in the "hot-house" air of the Isthmus; hospital accommodations and medical attention were inadequate, and the death rate was naturally very high. Much has now been learned by experience. It was found that negroes from the British Antilles can stand the climate wonderfully well, and they have been imported in large numbers to the Isthmus, and are now doing the hard labor on the canal. Proper medical attendance and excellent hospitals have been provided, and the result is that the death rate has been very much decreased. The barrier raised by the bad effects of the climate on the health of the employés has thus been largely removed.

In regard to the relative merits of the Nicaragua and Panama routes for an inter-oceanic canal, there are two considerations, both of them concerned with the climatic conditions, which favor the Panama route. The first is, that the difficult excavations and works of construction on the Panama canal come in a district where the mean annual rainfall is about 93 inches, while in the case of the Nicaragua canal the most difficult constructions lie in a region where the rainfall, as determined by the Canal Company, is 256 inches, or nearly three times as much. The second point is that in the case of the Nicaragua route there are strong trade winds, blowing much of the year, which will seriously interfere with the passage of vessels throught the canal, while in the case of the Panama route the winds are much less troublesome.

Health on the Gold Coast.—The Gold Coast of Africa has long enjoyed the unenviable reputation of being an extraordinarily unhealthy place for the white man to live in. The deaths among the European troops on the coast between 1829 and 1836 were 483

per 1,000 a year. Even to-day, although the death rate has been very much reduced, the climate conditions are such that the white man seems absolutely unable to cope with them. In a recent book, entitled *Nine Years at the Gold Coast*, by Rev. Dennis Kemp (Macmillan, 1898), the unhealthfulness of the climate is strikingly brought out in the following passage:

"On the homeward voyage a Government officer informed me that out of fifty Europeans who were at Cape Coast two years previously, only five were alive that day; which statement reminded me of the fact that an officer connected with the Ashanti expedition was informed that out of twenty who dined at the house of a British merchant on Christmas Day, 1894, only two were alive on the following Christmas Day."

RECORD OF GEOGRAPHICAL PROGRESS.

AMERICA.

THE BOUNDARY BETWEEN HAITI AND SANTO DOMINGO.—A despatch from Washington says that Haiti and Santo Domingo have agreed to refer their boundary dispute to Pope Leo XIII for settlement. Our knowledge of the central portions of the island is based largely upon the cartographic work of Schomburgk and Gabb, and upon Dantès Fortunat's four-sheet map of Haiti, published in 1888, the result in part of his own explorations. He was apparently the first to record the increase in Haiti's territory. His map showed the boundary considerably east of its former position, including in the Haitian domain the whole of the Valle de Guapa, and on the map a number of Haitian fortified posts were dotted along the new frontier. The grounds upon which this addition was made to the territory of Haiti have never been made quite clear. Haiti has nearly four times as many people to the square mile as live in Santo Domingo, and only about half as much territory.

REPLANTING AMERICAN FORESTS.—Fifty acres of the Adirondack burnt lands were replanted last spring with white pine and other conifers by the State College of Forestry at Cornell University, which has also started a nursery with enough seed to cover 2,500 acres with small trees two years hence. The College hopes to replant at least 500 acres of denuded lands every year. The New York *Sun* says that "Educational efforts in this direction should continue until it becomes an American habit to give back to the timber lands what we take from them." Our forestry industries and manufactures are worth to this country over a billion dollars a year, nearly half as much as our agricultural products, and two-fifths more than our entire mineral output. In working this source of profit we have been eating into our capital, but are beginning slowly to repair the damage done. Both New York and Pennsylvania have become forest owners on a large scale, and are applying forestry methods. Minnesota, Wisconsin and other States are moving in the same direction, and are legislating in behalf of forestry interests.

EUROPE.

EARTHQUAKES IN ICELAND.—*Globus* (No. 18, 1899) says that a series of earthquake shocks occurred in south-west Iceland near the

end of February. There were two rather intense shocks on the 26th in Reikjavik, and between 1 and 2 A.M. on the 27th three severe shocks occurred at short intervals, greatly alarming the people. On the following day there were more disturbances, the most severe at 5.30 P.M. At Cape Reykjanes the house of the lighthouse guard was damaged, and the stone fence around the garden was overthrown. A fissure 376 metres in length, from which smoke issued, opened near the hot spring Gunna, and in Kirkjuvogr a house was destroyed. There were no shocks in the region affected by the great earthquakes of 1896.

SNOWSLIDE IN NORWAY.—A unique phenomenon is reported to have occurred near Lilledal, a short distance inland from Christiania, Norway, on March 13. (*Deutsche Rundschau für Geog. und Stat.*, Vol. XXI, No. 8.) There was a very heavy fall of snow and a subsequent thaw that cleared much of the ice out of the river, which was heavily stocked with fish. During the night a snow avalanche, about 1,500 metres in length, slipped down the mountain side into the stream, and the momentum of the great mass forced much of the snow out of the river-bed and some distance up the slope of the mountain on the further side, carrying with it a large quantity of fish. For some days the people of the valley gathered out of the snow all the fish they could eat.

VIENNA.—A diagram relating to the City of Vienna, published in Dr. K. Peucker's "*Altas für Handelsschulen*" (Wien 1897), is of much interest as showing the exact uses to which all the ground within the limits of a great city has been devoted. A large addition was made to the city's area nine years ago, and it is not surprising to learn that almost exactly one-half of the entire surface is devoted to agriculture, pasturage, fruit and vegetable gardens. In addition to this, about an eighth of the city's area is timber land under private ownership. All the buildings of Vienna, with their front and back yards, if they have any, occupy an area not quite so large as that of the timber lands, or a little less than an eighth of the whole surface. In other words, if we eliminate the sparsely peopled part of Vienna, about one-quarter of the surface of the main city is occupied by buildings and the inclosed spaces around them. Streets and alleys are large consumers of space and occupy exactly one-twelfth of the whole city. To the parks and public grounds just about one-nineteenth of the area is devoted, a larger proportion than is given to these popular resorts in most cities. About one-

thirtieth of the entire area is given to wine gardens, which is just double the space devoted to church yards.

REFORMING THE RUSSIAN CALENDAR.—Civil time is still measured in Russia by the old Julian calendar, but steps have been taken which will probably result in the adoption by that country of the Gregorian calendar. Several departments of the Government have declared in favor of the change. This is the direct result of the agitation which was started by the scientifie societies of Russia. They agreed, in November, 1891, to keep the idea of reforming the calendar before the country, to endeavor to win for it the support of the educated classes and to popularize it. The situation has been becoming more inconvenient as Russia's business relations with other nations have expanded. Beginning next year and until the year 2100, the Russian calendar, unless reformed meanwhile, will be counted as thirteen days behind that of other nations, whose standard of time measurement is approximately accurate.

COMMERCIAL GEOGRAPHY AND STATISTICS.

THE WINE COUNTRIES.—The ravages of phylloxera placed France steadily behind Italy and Spain as a wine producer in the eight years 1884–91. France again leads the wine producing states, her production in 1898 being 852,801,000 gallons, that of Italy 832,137,500 and that of Spain 653,820,750 gallons. There is a long distance between these greatest producers and their nearest competitors. The total wine produced in twenty-five countries in 1897 was 2,843,478,900 gallons, and France, Italy and Spain supplied 2,059,688,000 of it. The wine yield of the United States in 1898 was 34,342,000 gallons, giving it the fifteenth place among wine-growing countries. Bulgaria, more than doubling its production in a year, passed the United States with a production of 68,686,000 gallons. Austria-Hungary's product was more than double that of the United States, Germany's was a third larger than ours, and Roumania, Russia, Portugal and Chili each produced about double the American output. Argentina and Chili were ahead of and Switzerland and Greece on about even terms with this country. Great Britain, Belgium, Holland and Scandinavia have no vineyards. The approximate yearly average of French exportations of wine is valued at $50,000,000, but France imports foreign wine for home consumption or re-export about equal in value to her export trade. Italy exports only about one-fifteenth of her product, and her imports are very small. The export of wines from Spain has increased

to an extraordinary extent in this decade, but is largely confined to the ordinary wines such as are introduced in great quantities into France to mix with French wines.

SPAIN'S COLONIAL POSSESSIONS.—Now that Spain has disposed of her remaining possessions in the Pacific Ocean to Germany, she retains colonial territorities only in North and West Africa and the neighboring waters. These possessions are the towns of Ceuta, Tetuan, Velez de la Gomera, Alhucemas and Melilla and the Chafarinas Islands, along the north coast of Morocco, the district of Ifni, on the south-west coast of Morocco, 27 square miles; the Canary Islands, administered as a province of Spain; the Rio de Oro district with a frontage on the Atlantic of about 500 miles, between Capes Bojador and Blanco, extending inland from 420 miles in the north to 600 miles in the south and embracing 243,000 square miles; the islands of Fernando Po and Annobon in the Gulf of Guinea; Corisco bay with its islands Corisco and Elobey and the adjoining district of San Juan. The total area of the present colonial empire is 247,308 square miles, but France contests the possession of a part of the Rio de Oro and San Juan districts.

GOLD IN THE RAND.—The gold output of the South African Republic in 1898 was $81,203,150. For two years this region has headed the list of gold producers of the world. Nine-tenths of the republic's enormous yield has for years been obtained from a strip of land 30 miles long and one to two miles wide, comprising about one-half of the gold-bearing area of the Witwatersrand (white water slope) that extends some 25 miles to the east and 30 miles to the west of Johannesburg. All indications are that the reefs, which have been explored to a depth of 2,500 feet, extend to a far lower level, and the fact that the ore is remarkably uniform for a gold deposit gives value, within certain limits, to the computations as to the quantity of metal within reach. Estimates for the whole area or parts of it have been made by Bergrath Schmeisser, John Hays Hammond, Messrs. Hatch and Chalmers, Professor De Launay of the Paris School of Mines, and other experts. Prof. De Launay, who has made the latest estimate, figures that for 25 miles of outcrop, less than half the Rand, the gold accessible to a depth of 1,000 metres (3,280 feet) is 2,600 to 2,800 million dollars. The mining engineers, however, are confident that the ore may be profitably worked to a depth of 5,000 feet, and on this basis, for the whole Rand, Messrs. Hatch and Chalmers figure that about

3,500 million dollars may be obtained. Mr. George F. Becker, of the U. S. Geological Survey, who examined the field, wrote: "I have found no grounds for regarding this as an overestimate." The total gold product of the world in the four centuries after the discovery of America was about 9,220 million dollars. It is thought possible, therefore, that the accessible gold in the Rand, with an area of about 100 square miles, may be equal to a third of the world's entire product for four centuries.

Coal Mining in Natal.—The rapid progress of coal mining in Natal is shown by the following figures, giving the output for the last six years in tons: 1893, 129,630; 1894, 141,000; 1895, 160,115; 1896, 216,106; 1897, 243,960; 1898, 387,811. The coal came from some 13 mines; 181,000 tons from the property of the Dundee Coal & Estate Co., 77,000 tons from the Elandslaagte collieries, and over 100,000 tons from four other mines.

Iron in Jerusalem.—Mr. Dickson, the British Consul at Jerusalem, writes that Belgian iron, which was hardly known in that market fifteen years ago, has now practically monopolized the trade, as it is delivered at Jaffa at about $10 a ton less than British iron.

Commerce and Calamity.—Greece's war with Turkey in 1897 did not diminish her export trade, and in fact her exports were $1,500,000 larger than in 1896, because her chief exports are currants, the crop was unusually large and so was the demand for it. The revolution of 1897 in Uruguay diminished the foreign trade by $6,379,000 in the first six months, as compared with the same period in 1896. The total trade of Cuba with the United States, which was nearly $96,000,000 in 1894, the year before the last insurrection began, dropped to $47,500,000 in 1896 and to $26,600,000 in 1897. In 1896 there was a partial crop failure in India and an outbreak of the plague in western India. A part of the subsequent demoralization of trade is traceable to these calamities. The foreign business in 1898 was 14.5 per cent. less in value than in 1895. The drought of 1895 in New South Wales reduced the stock of sheep, which is the chief source of profit in the colony, from 56,000,000 to 47,000,000, and a still more severe drought in 1896 augmented the evil and impaired the purchasing power of the people. The export of wool was $53,365,000 in 1891, but it fell off $10,000,000 in 1895.

Progress in Madagascar.—The *Comptes Rendus* of the Paris Geographical Society (1899, p. 16) says that the explorations of

Capt. de Thuy (Sept. to Dec., 1897), in the region of the large Mangoka River, which rises among the mountains behind the east coast, flows across the central plateau, and empties on the southwest coast, show that the greater part of it is navigable. His survey extended to its headwaters at the mission station of Fianarantsoa. An excellent road has been completed between the west coast port of Tamatave and Antananarivo, the capital. The improvements on the road between the northwest coast port of Majunga and the capital are not yet quite completed. The roads extending south from the capital to Fianarantsoa and Ihosy and that between Fianarantsoa and Mananjary on the east coast are still building, but are used to some extent for traffic. The only railroad yet decided upon is the proposed line between Tamatave and the capital, 371 kilometres long. The lagoons along the east coast between Tamatave and Andovoranto have been connected by canals, affording a waterway, thus far, on the road to Antananarivo. A lighthouse has been erected at Cape Amber, at the north end of the island, which facilitates entrance to the harbor of Diego Suarez. The telegraph system is constantly extending, the island is now peaceful and the French are pushing development with considerable rapidity. Transport animals for the roads are still scarce.

THE SUEZ CANAL.—The London *Times* of May 29 says that the receipts of the Suez Canal in 1898 amounted to 87,906,000 francs, exceeding those of any previous year. The increase is 12,299,000 francs over 1897, of which 10,855,000 francs arises from the growth in commercial traffic, and 1,141,000 from military expeditions. The vessels passing through numbered 3,503 of 9,238,000 tons, 227 of the vessels for the first time, and 3,294 by night. The average duration of transit was 15 hours 43 minutes. There were 59 transits of petroleum ships, formerly not admitted to the canal. England sent 2,295 vessels, Germany 253, France 221, Holland 193, Austria 85, Italy 74, Turkey 54, Spain 49, Russia 48, Norway 47, Japan 46, Egypt 10, Denmark 8, America 4, China 4, Portugal 3, Sweden 2, Greece 2, Rumania 1, and Argentina 1. Of the 219,000 passengers, English soldiers numbered 34,000, Russian 23,000, Turkish 23,000, French 14,000, Spanish 10,000, Italian 5,000, and Dutch 3,000. The civilian passengers numbered 79,000, and pilgrims and emigrants 17,000. The report speaks of the improvement in Indian trade and of the prospect of increased traffic from the events in China and railroad construction in Tonkin, Japan, Formosa and East Africa.

AFRICA.

REBUILDING OF KHARTUM.—Khartum, founded by Mohammed Ali as the capital of his possessions in the Sudan, was the largest city in the Nile basin, south of Cairo, up to the time of the Mahdist revolt. It was destroyed by the Khalifa Abdullah in 1886, only three buildings, the palace, the mission house and the arsenal, being spared, and Omdurman became the Mahdist capital. The work of rebuilding Khartum has begun. The streets will be widened and the greatest innovation will be the removal of the best part of the resident district to a more salubrious situation on the hills south of the old city. The sites for the Mohammedan University, to be founded with funds subscribed in Great Britain, the railroad station and other important buildings have been selected. Every effort is making to encourage the tribes from the Atbara River to Khartum to return to the fertile lands, on both banks of the Nile, they had abandoned. They will be permitted to reconstruct the irrigation ditches from the Nile to their fields, some thousands in number, only few of which are now in use.

The *Scottish Geographical Magazine* (March, 1899) says that under the terms of a convention signed at Cairo by Boutros Pasha and Lord Cromer, the British and Egyptian flags will be hoisted together in all parts of the Egyptian Sudan except in the town of Suakin, where the Egyptian flag will float alone. The supreme government of the Sudan will be intrusted to a governor-general appointed by a decree of the Khedive, with the sanction of the British Government. No preference shall be shown to the subjects of any particular Power emigrating thither. Customs dues shall not be levied upon goods entering the Sudan through Egyptian territory, but shall be imposed upon goods coming from elsewhere. At Suakin, however, and other ports on the Red Sea, the Egyptian tariff charges shall be collected on foreign goods. Duties may be levied on goods leaving the Sudan, and these may be modified from time to time by proclamation. The jurisdiction of the mixed courts shall not be extended to the Sudan, except at Suakin, but martial law shall be maintained for the present. The importation and exportation of slaves are prohibited and the two Governments will give special attention to the application of the Brussels act of 1890 relating to the importation, sale and manufacture of firearms, ammunition and spirituous liquors. Lord Kitchener of Khartum has been appointed the first governor general of Khartum.

POLAR REGIONS.

THE PEARY ARCTIC CLUB, supporting Civil Engineer Peary's expedition to the North Pole, has chartered for the coming summer the steamer *Diana*, of St. Johns, Newfoundland, 423 tons, Capt. Samuel W. Bartlett, of Brigus, Newfoundland, master, which will sail from Sydney, C. B., for Inglefield Gulf and Littleton Island, on July 20. The *Diana* has been chartered to replace the *Windward*, the Harmsworth steamer, on which Mr. Peary left Etah, Greenland, Aug. 12, 1898, for the North, and which has not yet returned. The *Diana* will take ample food supplies for the three parties, Mr. Peary's, the *Windward's*, and her own, in all about fifty men, for a full year, so that in case of any adverse chance, no question of subsistence will arise. The expedition is, however, expected to accomplish its work, the principal factor of which is the delivery of supplies to Mr. Peary at Bowdoin Bay or Littleton Island, and to return within two months. Prof. William Libbey, of Princeton, N. J., with three assistants, will sail on the *Diana*, on a scientific expedition, largely in the interest of biology and oceanography; Russell W. Porter, of Boston, will take a hunting party of five, and Robert Stein, of Washington, will be landed if possible with two or three companions at Ellesmere Land, to remain during the winter.

DR. NATHORST'S EXPEDITION, which sailed from Stockholm at the end of May, will land, if possible, on the east coast of Greenland between Lat. 73° and 76° and make a search for Andree as far to the north as Cape Bismarck, where it may meet with Sverdrup's party.

IN RECORDING THE FRUITLESSNESS of Martin's expedition to West Siberia to investigate the truth of the reports as to the finding of Andree's balloon, Dr. H. Wichmann (*Petermanns Mitteilungen, 45 Band, IV*) thinks it deplorable that men are to be found, who are ready to trifle with the most serious subjects, if only they may swagger for a few days in the public eye.

A TELEGRAM, DATED AT CHRISTIANIA, June 12, mentions the departure of the *Stella Polare*, with the Duke of the Abruzzi and his party, for polar exploration. The expedition consists of twenty-one persons: the Duke, Capt. Umberto Cagni, Lieut. Quiri, Dr. Cavalli-Molinotti, two Italian sailors, four mountain guides, ten Norwegian sailors and one Eskimo. They take 120 dogs.

The *Stella Polare*, formerly the *Jason*, has been rebuilt and

strengthened. She carries 350 tons of coal and 250 tons of provisions.

THE BELGIAN ANTARCTIC EXPEDITION.—The *Société Royale Belge de Géographie* communicates a letter received April 27 from Lieut. de Gerlache, the Commander of the *Belgica*, which arrived at Punta-Arenas, Magellan Strait, on the 28th of March. This letter adds some details to those given in the telegram announcing the safe return of the vessel.

Leaving Punta-Arenas, Dec. 14, 1897, the *Belgica* stopped to coal at Lapataia, an Argentine station near Ushuaia. This latter was left January 1 and soon after the *Belgica* grounded on a sunken rock, fortunately without serious damage, and it was not till January 14 that she left Staten Land and headed for the South Shetlands, which were reached on the 21st. The next day a Norwegian sailor, Wiencke, was lost overboard in rough weather. On the 24th a strait was discovered near Hughes Bay, and an archipelago to which was given provisionally the name of Palmer. Three weeks were spent in exploring these waters and the adjacent lands. February 16 Alexander I. island was sighted, enclosed by impenetrable ice, and for twelve days the ship followed the edge of the field. On the 28th, in S. Lat. 70″ 20′, Long. 85° west, with an east-north-east gale, great lanes were opened in the field. Into one of these the *Belgica* penetrated as far as Lat. 70° 31′, West Long. 85° 16′. By the 10th of March the ship was fast in the ice, and arrangements were made for the winter.

The temperature, it was found, varied with the wind. When the south wind blew, the weather was clear and cold, while with the north wind the sky was overcast, with frequent fogs and a temperature near to zero (freezing-point), and even at times a thaw began. The drift was directly due to the wind. By the 16th of May the ship had reached Lat. 71° 34′, West Long. 89° 10′, and on the 30th her position was in Lat. 71° 36′, Long. 87° 39′. The aspect of the pack ice underwent continual change. There was a great deal of wind throughout the winter and the snow-storms often made it impossible to work in the open. For the same reason and from the insecurity of the pack ice, there was no opportunity to make excursions of any duration.

The sun disappeared on the 17th of May, not to rise again till the 21st of July.

At the beginning of May Lieut. Danco fell ill and grew worse, in spite of all that could be done. He died on the 5th of June and was buried the next day.

In October the breaks and lanes in the pack ice multiplied, but for a mile around the ship the ice held. Not far away was a great floe, and on the side nearest the ship a channel had remained almost open from the beginning of the month. The summer was approaching, but there were days when, with a south wind, young ice began to form, and in January, 1899, it was decided to cut a channel with the saw, towards the large floe. The mean thickness of the ice was one metre, but near the ship it was more than two metres thick. In all there were between 2,500 and 3,000 metres of ice to be sawn through and cut into blocks of manageable size—a task that employed the energies of all for nearly three weeks. The ice closed up again on the 1st of February, and at the same time the ship began to feel the swell of the ocean. On the 13th, the propeller made a few turns, and by the morning of the 15th the ship had moved 15 or 16 miles to the northward. That night the pack closed again, and it was not till the 14th of March, at noon, that the *Belgica* reached open water.

During the second detention the wind was almost constantly from the east and the ship drifted to the westward. She left the pack in W. Long. 103°, Lat. 70° 30′, without sighting the land marked on the charts in 70° S. Lat., and 100° W. Long. The ship's drift and the soundings made, wherever possible, remove several degrees farther to the south the hypothetic outline of the southern continent in this part of the Antarctic zone. From the pack to Tierra del Fuego the sea was absolutely clear of ice.

The *Belgica*, after undergoing repairs, will return to Antwerp.

THE SEVENTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

The preliminary programme of the Congress gives a list of the honorary presidents, honorary vice-presidents, honorary foreign committee and honorary German committee, the executive committee and the special committees on organization, finance, etc.

The Congress will hold a meeting of welcome on the evening of September 27. The sessions will begin September 28, and will close on the 4th of October, the place being the new building of the Prussian House of Representatives.

The meetings of a general character will be held in the forenoon, those of the sections in the afternoon.

A special Ladies-Committee will do all in its power to make the sojourn of lady visitors agreeable and instructive.

Papers for the Congress must be sent in, as already announced, by the first of July. The length of a communication is not to exceed twenty minutes, and any one of four languages may be used —English, French, German or Italian.

Subjects are classified as follows:

GROUP I.—Mathematical Geography, Geodesy, Cartography and Geophysics. In this group twenty titles have been submitted.

GROUP II.—Physical Geography, with a list of twenty-six titles.

GROUP III.—Biogeography, with three papers on the geography of plants and one on the fauna of the steppes.

GROUP IV.—Anthropogeography, in which there are fifteen titles registered.

GROUP V.—Exploration and Travel, with a total of thirteen announcements.

GROUP VI.—Historical Geography, with six titles.

GROUP VII.—Methodology, Geographical Instruction, Bibliography and Orthography, in which five papers are entered.

The Permanent Bureau, established by the Sixth International Congress (London, 1895), will report on the Map of the World on a scale of 1 : 1,000,000, on the Dating of Maps, on the Topographical Survey of Africa, on Bibliography, and on the Orthography of Geographical Names.

Excursions have been planned: To the Siebengebirge-Rhein-Eifel-Mosel, to the Taunus-Rhein-Nahe-Lahn, to the Vosges Mountains, to the Thuringian Forest, to the Island of Rügen, to East and West Prussia, and Glacial excursions in the North German Plain. These plans may be modified.

PRESENTATION OF THE CULLUM MEDAL TO SIR JOHN MURRAY.

At the anniversary meeting of the Royal Geographical Society, held on the 5th of June in the theatre of the University of London, the chair was taken by the President of the Society, Sir Clements R. Markham.

The President announced that the Royal medals for the encouragement of geographical science and discovery had been awarded to two Frenchmen—the Founder's medal to Captain Binger and the Patron's medal to M. Foureau, both of them distinguished African explorers. The following other awards were also declared: The Murchison grant for 1899 to Mr. Albert Armitage, for his valuable scientific observations with the Jackson-Harmsworth expedition, and for his sledge journeys with Mr. Jackson to explore the western part of the Franz Josef group; the Back grant for 1899 to Captain P. M. Sykes, for his three journeys through Persia; the Gill memorial for 1899 to the Hon. David Carnegie, for his journey across the Western Australian desert in 1896–97; the Cuthbert Peek grant for 1899 to Dr. Nathorst, for his important scientific exploration of the Spitsbergen Islands and the seas between Spitsbergen and Greenland.

The medals and awards were then presented and the President delivered his anniversary address.

After resuming his seat at the conclusion, he rose again and said that the Society had been requested by its sister Society in New York to offer the facilities of its anniversary meeting to the American Ambassador for the purpose of presenting the medal of the Geographical Society of New York to their respected colleague, Sir John Murray. It was with great pleasure that they had acceded to that request, for their intercourse with the American Geographical Society had always been most friendly, and he was proud to say that its venerable president had been his friend for upwards of a quarter of a century. He would now ask his Excellency to present the medal.

Mr. Choate said:

MR. PRESIDENT AND GENTLEMEN OF THE ROYAL GEOGRAPHICAL SOCIETY: I ought to apologize for having come here late this afternoon to perform this pleasing duty, which I should have discharged at the time of the presentation of the other medals by your own Society; but, when I tell you that I had a previous engagement to be present at the gathering of the Master and Brethren of the Trinity House, at which his Royal Highness the Prince of Wales was present as the Elder Brother of the House, I am sure that will account for my absence. His Royal Highness was

pleased, when I told him of this engagement, to bid me God speed, and to tell me to take French leave and come here. Now, I appear here as the representative of the American Geographical Society of New York, and with the concurrence, I may say, of the Secretary of State of the United States, expressing on the part of the Government of that country full sympathy with the object which the New York Society has in view. I appear here as the bearer of that Society's gold medal to present to one of your most distinguished scientific men. The American Society is one of those associations that were formed for similar purposes to those of your own, many, many years ago, emulating the noble example which this Society had set to the world. Undoubtedly it has achieved great success on its own part. It has been the patron of many illustrious expeditions which have extended the bounds of geographical knowledge, and have acted no small part in advancing the science of geography, to which you are all so ardently devoted. But the spirit of science knows no geographical boundaries. It is in entire sympathy with efforts in the same direction that are being made the world around, and so, in assigning its really beautiful gold medal, they do not confine, and have never confined, themselves to the limits of their own country; but they look the world over for the worthiest to be its recipient. It is not for me to state in his presence what Sir John Murray has done to entitle him to such recognition on the part of a distant Society. You know, far better than I do, the great works which he has accomplished. I think it is all summed up in the front of this medal, and, in lieu of a longer speech, you will perhaps allow me to read what is there inscribed:—"Cullum Geographical Medal. Awarded to Sir John Murray, K.C.B., naturalist, deep sea explorer, oceanographer, editor of Challenger Reports, 1899." And on the reverse, "American Geographical Society of New York," with the relief of an ideal explorer, an ideal man of science, standing in the bow of his boat as he approaches what seems to me to be the Antarctic continent, shielding his eyes from the glare of the Polar southern sun, as he looks forward in search of this hoped-for country. Now that tells the whole story. If I were to have prepared an annual address I could not have stated it more succinctly or more fully. It gives me the greatest pleasure, on the part of the American Society and of the people of America, to be here to-day to make this presentation. I may say that science, together with art and literature, forms enduring links which will perpetuate the friendship which now exists between the two countries, for, if the brains of two nations are always working together, how can their hearts ever be far apart? So, Mr. President, by your leave, I deliver and present this medal to Sir John Murray, wishing for him, on the part of the Society which gives it and on that of the country I represent, long life and more distinction than he has already achieved. He is equally at home on the ocean as on dry land, and it is to enthusiasm, zeal, and perseverance such as his, always exhibited in the cause of science, that the future of science will be due, and the Arctic and Antarctic regions alike will give up their secrets until science shall have mastered the whole world.

Sir John Murray, in acknowledging the honour conferred upon him, said that he regarded the award as made not so much for any personal merit of his own as in recognition of the value of the work which had been performed by the great expedition with which his name was so very often associated, and the honour was therefore shared by all his colleagues, naval, literary, and scientific. It was like a silken thread of sympathy outstretched between two great kindred nations.

BOOK NOTICES.

The Philippine Islands: A Political, Geographical, Ethnographical, Social and Commercial History of the Philippine Archipelago and Its Political Dependencies, Embracing the Whole Period of Spanish Rule. By John Foreman, F.R.G.S. Second Edition, Revised and Enlarged, with Maps and Illustrations. New York, Charles Scribner's Sons, 1899.

Mr. Foreman's book, first published in 1890, took its place at once as the best work on the Philippines, in English.

This new edition has been rearranged and augmented by a full account of the events of the past eight years. The author attributes the native uprising and the loss of the colony primarily to the abuses of the clerical authority and privileges. He writes without prejudice, either religious or national, and he wins the confidence of his readers.

The map of the islands is a simple reprint of that in the first edition.

The Statesman's Year-Book, Statistical and Historical Annual of the States of the World for the Year 1899. Edited by J. Scott Keltie, LL.D., and I. P. A. Renwick, M.A., LL.B. American Edition, Edited by Carroll D. Wright, LL.D., United States Commissioner of Labor, President of the American Statistical Association. Thirty-Sixth Annual Publication. Revised after Official Returns. New York, The Macmillan Company; London, Macmillan & Co., Ltd. 1899. All rights reserved.

Mr. Wright's preface says:

> The English editions of "The Statesman's Year-Book" have contained about forty pages relating to the United States. The American publishers conceived the idea that the public would welcome an edition containing more extended data . . . . . The difficulty has been to keep the work within necessarily prescribed limits. It would have been an easier task to have compiled a whole volume on the United States.

The forty pages of the previous editions are represented in the present volume by 280 pages, filled with what seems to be an excellent summary of statistical information. Some of the details, such as the list of the Senators and Representatives and the account of the Spanish war, are unexpected, perhaps unnecessary, in a work of this character; but one must not object to a heaped up measure.

In accuracy and usefulness the American edition of the Year-Book is worthy of its predecessors.

The Break-Up of China. With an Account of its present Commerce, Currency, Waterways, Armies, Railways, Politics and Future Prospects. By Lord Charles Beresford. With Portraits and Maps. New York and London, Harper & Brothers, Publishers. 1899.

This bulky volume is a report on a mission confided to the author by the President of the Associated Chambers of Commerce, to obtain accurate information as to how security is to be insured to commercial men who may be disposed to embark their capital in trade enterprise in China.

In framing his report Lord Charles has found it impossible to ignore conditions inseparable from the commercial question—viz., matters relating to international, racial and political complications. He says in his preface:

> Investigations on the spot have convinced me that the maintenance of the Chinese Empire is essential to the honor as well as the interests of the Anglo-Saxon race, and I hope that when the British and American people are acquainted with the facts as a whole, they will be similarly convinced.

It is well with a man or with a race when self-interest and honour point the same way; but men sometimes deceive themselves in trying to read the signs of the times. What is called the Anglo-Saxon race may be regarded, from a sentimental point of view, as one and indivisible, but it is, in fact, divided against itself and it has divided interests. Some of these interests may be bound up with the maintenance of the Chinese Empire, and, if so, they are in peril. As for the honour of the race, that is a different matter. In what way does the maintenance of the Chinese Empire concern the honour of the American people? Is Lord Charles Beresford quite sure that his countrymen are ready to look upon themselves as lost to name and fame if China fall? His preface is like an echo of the late David Urquhart's preachments on the sacredness of the Turkish Empire. The British public, it may be supposed, has its own thoughts on the subject of the national honour.

Lord Charles has written a book filled with useful information about China. He comes to the conclusion that the British merchants can hold their own, if they are supported, but that there is no security for them under the present Chinese Government. He thinks much might be done if the administration, civil, military and naval, were in the hands of Europeans. What would be Chinese? He writes around his subject, and fails to mention the one decisive fact in the Chinese situation—the absence of a national life. There is no nation in China. There is a people, industrious, sober, sub-

missive, ready to be organized and directed when it finds a master. To maintain China is to maintain a government without force, in a people without cohesion.

Hawaii . . . Our New Possessions. An Account of Travels and Adventure, with Sketches of the Scenery, Customs and Manners, Mythology and History of Hawaii to the Present, and an Appendix containing the Treaty of Annexation to the United States. By John R. Musick, author of the "Columbian Historical Novels." Illustrated with Fifty-six Full-Page Plates, containing over One Hundred Half-Tone Reproductions from Photographs, with Border Decorations by Philip E. Flintoff and Thirty-four Pen Sketches by Freeland A. Carter. Also a Map of the Hawaiian Islands. Funk and Wagnalls Company, New York and London. 1898.

The illustrations seem to be the best things in this big book. The text is sketchy, the travels and adventures are not entertaining, the descriptions of scenery are laboured, and the history does not inspire confidence. The excuse for the work, as stated in the preface, is that no American volume on the Islands has appeared since the recent change in the order of things there, and that people in the Eastern and Middle States know comparatively little about the country. This is, perhaps, an overstatement of the case. The Hawaiian Islands have attracted a good deal of attention in recent years, and there is abundant information concerning them within the reach of all who wish to know. Some of this naturally reappears in Mr. Musick's pages, but he contributes much original matter.

The Royal Road to Geography, with a Criticism on the Present Method of Teaching Geography in Primary Schools. By A. Perianayakam, B.A., Headmaster, C. M. High School, Srivilliputur. "No man also having drunk old wine straightway desireth new: for he saith, The old is better." Madras: Printed at the S. P. C. K. Press, Vepery. 1898. [*All Rights Reserved.*]

Mr. Perianayakam finds that geography is badly taught and that the evil lies in the auxiliaries employed: the kindergarten system and maps.

The division of land and water, the mouth of a river, the hill, the mountain and the plain, in kindergarten teaching, are represented by a variety of arrangement with bricks, or blocks. This is declared to be outrageous. Just consider boys and girls how they play. In building houses sand in straight lines represents the

wall; gaps in the line are doorways; pieces of stick, door-posts; and so on. In one word, says Mr. Perianayakam, *all the objects used by children are allied to those they are made to stand for.*

The map, instead of being a help in the primary course, is held to be a hindrance. The teacher explains that the top of the map is north, and the children conclude that if the map is hung up by the bottom the bottom becomes north. In the same way, the top of a steeple or of a tree may be imagined to be in the north.

All the objects in a map lie on the same plane, and no adequate impression is produced as to the relative size of towns and rivers, the heights of mountains, the productions, the population, the animals, the trees, etc. Rivers are made to defy the law of gravitation. The map fails to answer a child's questions: Are there wild animals in the sea? Is the sea larger than our well? What does a mountain look like? Do bandies (carts) go over the sea?

A child fancies that the colour of a country in the map corresponds to the colour of the soil, and so conceives a liking for one country and a prejudice against another.

Srivilliputur is the chief town of the sub-division Srivilliputur, Tinnevelli District, Madras Presidency. In the fifty pages of his little book, Mr. Perianayakam shows how he would teach the geography of Tinnevelli.

In Lesson 13 (on Islands) Mr. Perianayakam handles with a light touch the facts of the human anatomy and of etymology:

T.—What is the difference between our district and that piece of land (pointing)?

P.—That piece of land is surrounded by water.

T.—What organ in our face is surrounded by water which sometimes overflows its bounds?

P.—The eye.

T.—Yes. That piece of land (pointing) is like the eye. What shall we call it then?

P.—Eye-land.

T.—Yes, eyeland or island. What is an island?

P.—It is land surrounded by water.

Lesson 14 is on the People of the district, illustrated by the models of three different races. It begins:

T.—Put the figures of robust men in North Tinnevelly for the people here are taller and stronger than those of the south. Put the models of Europeans at Palamcottah, Tinnevelly, Tuticorin, Ambasamoodram, Virudupatti, and Satur; and those of Arabs at Palamcottah and Tuticorin. What have Englishmen come here for?

P.—(1) To preach Christianity, (2) to govern the country, and (3) to trade.

T.—What have Arabs come here for?

P.—To trade—in horses and asafœtida.

T.—Name as many points of difference as you can between Hindus and foreigners in dress, &c.

P.—Hindus do not protect their feet which foreigners do. (2) Hindus grow their hair into a long tuft but foreigners cut their hair short. (3) Hindus wear cloth but all foreigners trousers. (4) Hindus have more costly ornaments and jewels than foreigners. (5) Natives of India have marks of religion on their forehead but no foreigner has any such mark. (6) The head dress of the Hindu is much larger than that of the foreigner.

Each dress is admitted to be best suited to the country in which it is used, and the dress of "foreigners" is said to be the best for running, jumping, etc.; an implied recognition of the Englishman as the only foreigner.

Mr. Perianayakam's spelling of Indian names does not always agree with that of Sir W. W. Hunter.

ACCESSIONS TO THE LIBRARY.

MAY–JUNE, 1899.

BY PURCHASE.

Views of Ancient Monuments in Central America, Chiapas and Yucatan, by F. Catherwood, London, 1844, portfolio; On Sledge and Horseback to Outcast Siberian Lepers, by Kate Marsden, 2nd edition, London (1895), 8vo; Paul Pendril, or Sport and Adventure in Corsica (E. W. L. Davis), London, 1866, 8vo; Brighter South Africa, by J. Ewing Ritchie, London, 1892, 8vo; Memoirs of Libraries, by Edward Edwards, London, 1859, 2 vols. 8vo; Shrines and Sepulchres of the Old and New World, by R. R. Madden, London, 1851, 2 vols. 8vo; Turkish Life and Character, by Walter Thornbury, London, 1860, 2 vols. 8vo; The Beginnings of New England, by John Fiske, Cambridge, Mass., 1898, 8vo; The Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaites, Vols. XLI–XLIV, Cleveland, 1899, 8vo; The Statesman's Year-Book, 1899, American Edition, New York, 1899, 8vo; Chorographia Britanniæ, by Thos. Badeslade, London, 1742, sm. 8vo; A Sketch of a Tour on the Continent, 1786–1787, by James Edward Smith, London, 1793, 3 vols. 8vo; Travels through Italy in 1804 and 1805, by A. von Kotzebue, London, 1806, 4 vols. 8vo; Oude Hollandsche Steden aan de Zuider Zee, door W. O. J. Nieuwenkamp en J. G. Veldheer, Haarlem, 1897, 4to; The Crimea and Transcaucasia, by J. Buchan Telfer, London, 1876, 2 vols. in 1, 8vo; Comparative Geography of Palestine and the Sinaitic Peninsula, by Carl Ritter, translated by W. L. Gage, Edinburgh, 1866, 4 vols. 8vo; The Life of Gordon, by Demetrius C. Boulger, London, 1896, 2 vols. 8vo; The Riviera, Ancient and Modern, by Charles Lenthéric, translated by Charles West, London, 1895, 8vo; A Cruise upon Wheels: Autumn Wanderings among the Deserted Post-Roads of France, by Charles Allston Collins, London, 1863, 2nd edition, 8vo; Narrative of an Ascent to the Summit of Mont Blanc, by John Auldjo, London, 1830, 2nd edition, 8vo; The Story of Our Continent, by N. S. Shaler, Boston, 1892, 16mo; Nature and Man in America, by N. S. Shaler, New York, 1891, 16mo; Gieseckes Mineralogiske Rejse i Grönland, ved F. Johnstrup, Kjöbenhavn, 1878, 8vo; The Arctic Expedition of 1875–6, by R. Johnston, London (1877), 8vo; Journal of a Voyage of Discovery to the Arctic Regions, 1818, in H. M. S. "Alexander," by an Officer of the "Alexander" (Fisher), London, s. a., 8vo; I Drift med Isen i Kara-Havet, af A. T. Olsen, Kjöbenhavn, 1891, 12mo; Optegnelser fra den österrigsk-ungarske Polarexpedition (1872–1874), ved E. Carlsen, Tromsö, 1875, 8vo; Journal of Capt. Collinson, R.N., C.B., of H. M. S. "Enterprise," between July, 1851, and August, 1854, in the Arctic Regions, Newcastle-upon-Tyne, 1854, 8vo; "Albert's" Expedition til Spidsbergen i November og December, 1872, af H. Mohn (Christiania, 1873), 8vo; Official Report of the Recent Arctic Expedition, by Captain Nares, London, 1876, 8vo; Den Danske Konebaad's-Expedition til Grönlands Östkyst, af G. Holm og V. Garde, Kjöbenhavn, 1887, 8vo; Icebergs in the Southern Ocean, by John Thomas Towson, Liverpool, 1852, 8vo; Le Plus Beau Royaume sous le Ciel, par Onésime Reclus, Paris, 1899, 4to; Geographisches Jahrbuch, 1899, Gotha, 1899, 8vo; Nordpolar Karte, von V. v. Haardt, Wien (1898), sheet; The Story of Our English Towns, by P. H. Ditchfield, London, 1897, 8vo; Society in the Elizabethan Age, by Hubert

Hall, London, 1892, 3rd edition, 8vo; Egypt To-Day, by W. Fraser Rae, London, 1892, 8vo; Chronicle of the Discovery and Conquest of Guinea, by G. E. de Azurara, now first done into English by Chas. Raymond Beazley and Edgar Prestage, London, 1899, 8vo, Hakluyt Society; La Colonia Eritrea dalle sue origini fino al 1° Marzo, 1899, B. Melli, Parma, 1899, 8vo; Les Anglais aux Indes et en Égypte, Eugène Aubin, Paris, 1899, 8vo; Les Grandes Compagnies Coloniales Anglaises du XIX^{ème} Siècle, par Edmond Carton de Wiart, Paris, 1899, 8vo; Old World Japan, by T. H. Robinson, New York, 1896, 8vo; The Melanesian Languages, by R. H. Codrington, Oxford, 1885, 8vo; The Climates and Baths of Great Britain, Being a Report, etc., Vol, I, London, 1895, 8vo; The History of India, by J. Talboys Wheeler, 4 vols. in 5, London, 1867–1881, 8vo; Native Tribes of Central Australia, by Baldwin Spencer and F. J. Gillen, London, 1899, 8vo; Remarkable Maps of the XVth, XVIth and XVIIth Centuries, Supplement II–III, Huych Allardt's Map of India, with Notes by J. E. Heeres, LL.D., Amsterdam, 1899, sheet; The Land-Systems of British India, by B. H. Baden-Powell, Oxford, 1892, 3 vols. 8vo; The Isles of Summer, by Charles Ives, New Haven, 1880, 12mo; The Italian Sketch-Book, by (H. T. Tuckerman), Philadelphia, 1835, 12mo; Memories of Our Great Towns, by John Doran, London, 1882, new edition, 8vo; Tuscan Cities, by W. D. Howells, Boston, 1886, 4to; Chamois Hunting in Bavaria and the Tyrol, by Charles Boner, new edition, London, 1860, 8vo; The New York Obelisk, by Chas. E. Moldenke, New York, 1891, 4to; History of the County of Westchester, by Robert Bolton, Jr., New York, 1848, 2 vols. 8vo; Evidence as to Man's Place in Nature, by Thomas H. Huxley, New York, 1863, 12mo; On the Origin of Species, by Thomas H. Huxley, New York, 1872, 12mo; American Resorts, with Notes upon their Climate, by Bushrod W. James, Philadelphia and London, 1889, sq. 8vo; Recherches pour servir à l'Histoire de la Piraterie, par M. le Chevalier D. A. Azuni, À Gênes, 1816, 8vo; Seven Eventful Years in Paraguay, by George Frederick Masterman, London, 1869, 8vo; Life in Santo Domingo, by A Settler, New York, 1873, 12mo; Economic History of Virginia in the Seventeenth Century, by P. A. Bruce, New York, 1896, 8vo; Scenas da Vida Amazonica, por José Verissimo, Lisboa, 1887, 8vo; Historia de Gibraltar y de su Campo, por D. Francisco Maria Montero, Cádiz, 1860, 8vo; La Havane, par M^{me}. la Comtesse Merlin, Bruxelles, 1844, 3 vols. 12mo; Los Indios Caribes, Memorias Interesantes de Venezuela, por R. Lopez Borreguero, Madrid, 1875, 16mo; Historia General de las Cosas de Nueva España, Bernardino de Sahagun, *Ed.* C. M. Bustamante, México, 1829–30, 3 vols. 8vo; Las Historias del Origen de los Indios de esta Provincia de Guatemala, por Francisco Ximenez, Vienna, 1857, 8vo; Diccionario Trilingüe Castellano, Bascuence y Latin, por M. de Larramendi, San Sebastian, 1853, 8vo; Annuaire-Almanach du Commerce, etc., Didot-Bottin, Paris, 1898, 4to; Vetera Romanorum Itineraria, etc., Petrus Wesselingius, Amstelædami, 1735, 4to; Nomenclator Comercial, etc., de la Isla de Cuba, Habana, 1883, 8vo; Censura de Historias Fabulosas, Obra Posthuma de Don Nicolas Antonio, publicada por Mayàns y Siscàr, Valencia, 1742, 4to; Bibliotheca Hispana Vetus, ab Octaviani Augusti ævo ad annum MD., Auctore D. Nicolao Antonio, etc., Matriti, 1788, 2 vols. 4to; Bibliotheca Hispana Nova, sive Hispanorum Scriptorum qui ab anno MD ad MDCLXXXIV Floruere Notitia, Auctore D. Nicolao Antonio, Matriti, 1783–1788, 2 vols. 4to; Ensayo de una Biblioteca Española de Libros Raros y Curiosos, etc., de D. Bartolomé José Gallardo, Madrid, 1863–1866, 2 vols. 8vo; Relacion Historica del Viage a la America Meridional, por Jorge Juan y Antonio del Ulloa, Madrid, 1748, 4 vols. 4to; Noticias Historicas de la Nueva España, por D. Justo Zaragoza Madrid, 1878, 4to; Reisen in Britisch-Guiana in den Jahren, 1840–1844, von Richard Schomburgk, Leipzig, 1847–1848, 3 vols. 8vo;

Theatrum Geographiæ Veteris, Petrus Bertius (2 Tom. in 1), Lugduni-Batavorum. 1618, folio; Peutingeriana Tabula Itineraria, F. C. de Scheyb, Vindobonæ, 1753, folio; An Illustrated Flora of the Northern United States, Canada and the British Possessions, by Nathaniel Lord Britton, Ph.D., and Hon. Addison Brown, New York, 1896–98, 3 vols. and index vol., 8vo; Historia do Brasil, até á abdicação do Imp. D. Pedro I, por Francisco Solano Constancio, Paris, 1839, 2 vols. 8vo; Historia Geral do Brazil (Fr. Adolpho de Varnhagen), Rio de Janeiro, 1854–1857, 2 vols. 8vo; Derrotero de las Islas Antillas y Costas Orientales de América, Parte 1ra, Madrid, 1877, 8vo; Military Map of the Island of Luzon (War Department), New York, 1898, 2 sheets; Map of the Province of Cavite (War Department), New York, 1898, sheet; Annual Cyclopædia, 1898, New York, 1899, 4to; The Philippine Islands, by John Foreman, 2nd edition, New York, 1899, 8vo; Picturesque Sicily, by William Agnew Paton, New York, 1898, 8vo; The Break-Up of China, by Lord Charles Beresford, New York, 1899, 8vo; Earth-Sculpture, or the Origin of Land-Forms, by James Geikie, New York, 1898, 8vo; The Soil: Its Nature, Relations, etc., by F. H. King, New York, 1898, 8vo; Hawaii, by John R. Musick, New York, 1898, 8vo; The Awakening of a Nation—Mexico of To-day, by Charles F. Lummis, New York, 1899, 8vo; North America, by Frank G. Carpenter, New York (1898), 16mo; The Earth and Its Story, by Angelo Heilprin, New York, 1898, 12mo; Outlines of the Earth's History, by N. S. Shaler, New York, 1898, 12mo; Views in Africa, by Anna B. Badlam, New York, 1899, 12mo; Elements of Geography, by Alexis E. Frye, Boston and London, 1898, 4to; Au Congo Belge, Pierre Mille, Paris, 1899, 18mo; The Memorial History of Boston, including Suffolk County, Mass, 1630–1880, Edited by Justin Winsor, Boston, 1880–1881, 4 vols. 8vo; Travels through Denmark and Sweden, etc., by Louis de Boisgelin, London, 1810, 2 vols., 4to.

GIFTS.

From the Boston Public Library, Boston, Mass.:

A Selected Bibliography of the Anthropology and Ethnology of Europe. By William Z. Ripley, Boston, 1899, 12mo.

From Chas. P. Daly:

Big Game Hunting in the Rockies and on the Great Plains, by Theodore Roosevelt, New York and London, 1899, 4to; The Colonial Policy of the United States, by L. T. Chamberlain, New York, 1899, 12mo; Third Annual Report of the New York Zoological Society, New York, 1899, 8vo.

From the Estate of M. Romero:

Mexico and the United States, by Matías Romero, New York and London, 1898, 8vo; Coffee and India-Rubber Culture in Mexico, preceded by Geographical and Statistical Notes on Mexico, by Matías Romero, New York and London, 1898, 8vo.

From William Libbey, Princeton, N. J.:

Princeton in the Spanish-American War, 1898. Princeton, N. J. (1899), 8vo.

From Lodian W. Lodian:

A Tibetan rapier and a Tibetan hammock.

From A. Perianayakam, B.A., Headmaster, C. M. High School, Srivillipatur, Madras Pres., Author:

The Royal Road to Geography, with a Criticism on the Present Method of Teaching Geography in Primary Schools, Madras. 1898, 12mo (2 copies).

From E. L. Plumb:

Human Longevity: Recording the Name, Age, etc., of 1712 Persons who attained a Century, etc., by James Easton, Salisbury, 1799, 16mo.

From the Université Laval, Quebec:

Les Derniers Jours de l'Acadie (1748–1758), Correspondances et Mémoires, extraits du portefeuille de M. Le Courtois de Surlaville, Lieutenant-Général des Armées du Roi, Ancien Major des troupes de l'Ile Royale, Mis en Ordre et Annotés par Gaston du Boscq de Beaumont. Paris, Librairie Historique des Provinces, Emile Lechevalier, 39 Quai des Grands-Augustins, 1899, 8vo.

From Frank Vincent:

Two Photographs of Port Louis, Mauritius, before and after the Hurricane, 1892.

From the Adjutant General's Office, War Department, Washington:

Carta General (en dos hojas) del Archipiélago Filipino, etc., etc., al mando de D. Claudio Montero y Gay, etc., Madrid, 1875. Issued by the War Department, Adjutant General's Office, Military Information Division, 1899.

NOTES AND NEWS.

THE TRUSTEES of the Boston Public Library have published a Selected Bibliography of the Anthropology and Ethnology of Europe, containing nearly two thousand titles.

The author, Mr. William Z. Ripley, says in his preface:

> This bibliography is the outgrowth of lectures delivered since 1893 at Columbia University, New York, and before the Lowell Institute in Boston. The preparation of them for final publication as "The Races of Europe" [3822.250] rendered necessary an exhaustive examination of the original sources of information . . . . . Almost all of the titles have been taken from the original sources. The proof has been submitted to nearly a hundred of the leading authorities in Europe.

It is a worthy local pride, which calls attention to the resources offered for the study of this branch of science by the Boston Public Library, and made accessible through a catalogue so admirably arranged and so beautifully printed.

IN COMPARING the longitude of points in the island of Luzon reference was made recently to various authorities for the position of the observatory of San Fernando (Cadiz). Among the works consulted was *Longmans' Gazetteer of the World*, 1895, in which (*art.* Cadiz, bay.) the San Fernando observatory is placed in 36° 27′ 45″ lat., 25° 9′ W. long. The true longitude is 6° 12′ 24″ West of Greenwich, and the error calls for correction in the next edition of the *Gazetteer*.

THE ROYAL ACADEMY of Sciences of Turin will, under the will of the late Signor Vallauri, award a prize to the author of any nation, who, between the 1st of January, 1899, and the 31st of December, 1902, shall have published the most important and the most celebrated work in the domain of physical sciences, taking this term in its widest acceptation.

The Academy will also award a prize to the scholar of any nation, who, between the 1st of January, 1903, and the 31st of December, 1906, shall have published the best critical work upon Latin literature.

In each case the works must be printed before they are submitted to the Academy. Each prize will consist of 30,000 lire, minus the tax on Italian *rente*.

THE VIENNA Geographical Society begins, with the month of May this year, the publication of its *Abhandlungen* in large octavo

form. This first number of the first volume contains four papers: New Results and Problems of Glacier Study, by E. Richter; Studies of Ice-Caves and Wind-Passages (with 5 plates), by H. Crammer; Lake Studies (with 3 plates), by I. Damian; and a Memorial of the honorary President of the Society, the distinguished geologist Franz Ritter von Hauer, who died on the 20th of March at the age of 77 years, after a long and painful illness.

Dr. DANIEL G. BRINTON, Professor of American Archæology and Linguistics at the University of Pennsylvania, has presented to the University his books and manuscripts relating to the aboriginal languages of North and South America.

The collection represents the accumulation of twenty-five years, and embraces about 2,000 volumes, in addition to nearly 200 volumes of bound and indexed pamphlets on the ethnology of the American Indians. Many of the volumes are rare or unique, and of bibliographical importance.

The works on the hieroglyphic writings of the natives of this country embrace nearly every publication on the subject. The special feature of the library is that it covers the whole American field, and was formed for the purpose of comparative study.

THE OFFICE of Naval Intelligence at Washington prints in *Part I: General Information Series, No. XVIII*, the translation of a paper on the Principal Navies of the World in 1898 by Naval Constructor Süssenguth, of the Imperial German Navy.

It is to be supposed that the translation does justice to the author; but it is not easy to believe that he wrote the name *Guiseppe Garibaldi*, which appears three times on page 27.

THE PROGRAMME of the Scientific Excursions arranged by the management of the Seventh International Geographical Congress comes to hand at a late moment. It gives in detail the following plans:

September 19. From Bonn to the Siebengebirge. (6 marks.)
" 20. From Bonn to Linz and Rolandseck. (6 marks.)
" 21–25. Five days in the Eifel-Moselle country, starting from Bonn and ending with Coblentz. (70 marks.)
" 21–26. The Taunus-Rhine-Nahe-Lahn excursion, beginning at Homburg and closing at Giessen. (75 marks.)
" 21–25. The Vosges Mountains. Departure from and return to Strassburg. (70 marks.)
" 23–27. Thuringen: To start from Eisenach and end at Jena. (70 marks.)

September 22–27. Rügen. The excursion to begin at Greifswald and end at Stralsund. (55 marks.)

" 22–27. East and West Prussia: From Königsberg to Danzig. (100 marks.)

October 1. Glacial Excursion to Rüdersdorf, near Berlin.

" 7–11. Glacial Excursion to the North-German Plain. This will start from Hamburg and end at Stargard in Pomerania. (74 marks.)

Applications must be sent in by the 15th of July, enclosing the sum of ten marks (not required for the Rüdersdorf excursion). This payment is not to be returned, even if the application is withdrawn. In some instances there will be additional charges for hotel accommodation and meals.

THE BULLETIN of the Geological Society of America (Vol. 10, Pp. 285–348, Pls. 30–32) is a paper on the Physiography and Geology of (the) Region Adjacent to the Nicaragua Canal Route, by Mr. C. Willard Hayes. The author's conclusion, somewhat condensed, is as follows:

The rainfall on the Caribbean side is abundant and distributed uniformly throughout the year. On the Pacific side it is less abundant and is confined to half the year. This climatic difference produces striking differences in vegetation, rock decay, rate of erosion and topographic forms;

The rocks are largely volcanic, with two sedimentary formations of Tertiary age, and no rock occurs certainly older than the Tertiary;

On the east side the rock decay has extended to great depths, with red clay as the product. On the west side the final product is blue clay;

In early Tertiary (Oligocene) time there was probably free communication between the two oceans;

In middle Tertiary the region was elevated, and there is no evidence of open communication across this portion of the isthmus since the uplift;

In post-Tertiary time the region was again elevated;

A recent subsidence has drowned the lower courses of the river valleys and the estuaries have been filled with alluvial deposits;

Lakes Managua and Nicaragua occupy the bed of a bay which formerly indented the Pacific coast, and the basins of rivers which were tributary to it. This theory is supported by the fact that certain marine forms are found in Lake Nicaragua—a species of

Megalops, a shark and a sawfish—and Mr. Hayes states, on the authority of Dr. Gill, that the sharks of Lake Nicaragua are specifically identical with those of the adjacent Pacific, but distinct from those found in the Caribbean Sea.

PRINCE ALBERT of Monaco sends a report of his Oceanographic Expedition to the Polar Regions, in 1898 (*Bulletin du Muséum d'Histoire Naturelle*), together with a summary of the results, from the *Comptes Rendus* of the Academy of Sciences.

The explorations were on the coasts of Spitzbergen and Norway and in the Greenland Sea.

Twenty-eight soundings were taken, to the depth of 3,310 metres (10,860 feet), mostly above the Arctic Circle, and as far as 80° 34′ lat.

Drift-wood and birch-bark, found on the eastern coasts of Bear Island and Hope Island, seem to show that the currents set steadily from the east against these islands.

The geological specimens brought from Hope Island were submitted to Dr. Nathorst, and a study of them confirmed his theory of its jurassic formation.

In zoology, the new species were not numerous, but some light was thrown on the geographical and bathymetric distribution of certain forms. The fauna of the Arctic is very different from that of the Azores; but some of the marine animals obtained in the Atlantic at a great depth were found in the north much nearer the surface and very much more vigorous.

In a day spent on Bear Island, Prince Albert was struck by the fearlessness of the birds and their indifference to the presence of man. Throughout the region of Spitzbergen there was the same condition, and everywhere the number of the birds was beyond calculation; and, on one occasion in Temple Bay, at a point where a torrent discharged, the birds covered the water for about the space of an acre, while the air for sixty feet above them swarmed with others coming to the feast.

The reindeer were almost tame, or, as Sir Martin Conway calls them, careless and stupid beasts.

Spelling reform has invaded even the Arctic. In the *Bulletin du Muséum* the Prince writes *Spitsberg*, while in the *Comptes Rendus* he uses the accepted French form *Spitzberg*, out of deference, perhaps, to the Academy. On the other hand, the printer must be held responsible for the date in Roman numerals: MDCCCXCXIX.

Dr. H. Fritsche, Director Emeritus of the Imperial Russian Observatory at Peking, sends a pamphlet of 112 pages, lithographed at St. Petersburg, apparently from his own manuscript, on the Elements of Terrestrial Magnetism for the Epochs 1600, 1650, 1700, 1780, 1842 and 1885, and their Secular Variations, calculated with the help of the Coefficients of Gauss's "General Theory of Terrestrial Magnetism," deduced from all available observations.

The Introduction, which fills four closely-written pages, has some critical remarks on papers by Dr. Louis A. Bauer and V. Carlheim-Gyllensköld and on Dr. A. Schmidt's unfinished work on Erdmagnetismus, and his article in the *Annalen der Hydrographie und Maritimen Meteorologie*, for January, 1898.

BIBLIOGRAPHY OF GEOGRAPHICAL WORKS PUBLISHED IN THE UNITED STATES IN 1898.*

INTRODUCTION.—The increasing custom among investigators of publishing their results in the form of brief articles in the numerous periodicals is increasing proportionately the need of bibliographies. Since geographical writings are of such wide range, and interest so varied a class, they find their way into a particularly large number of periodicals. Although valuable international bibliographies of such writings are published in Europe, none has come to the writer's attention which deals solely with the writings of this country; the present record is offered therefore as a beginning in this direction.

This bibliography comprises the more important geographical works published in this country in 1898. It gives, for separate works and articles, authors, full titles and abbreviated references. The arrangement is alphabetically by authors. In referring to books the following order has been observed: author, title, place of publication, name of publisher, year of publication, size of volume, number of pages, figures, plates and maps, scale of maps, and price when practicable. In the case of writings in periodicals, following name of author, and title, are title and volume of periodical, year of publication, number of first and last pages of article, number of figures, plates, etc. The abbreviations used in the references are self-explanatory. For the sake of completeness, certain writings bearing the date 1897 are included here; since some of these did not appear until the following year, and others came out too late to be included in the bibliography of 1897.

Excepting titles of five recent publications, this bibliography, together with brief summaries of the writings, was originally prepared for the annual international bibliography of the Annales de Géographie (published by Armand Colin et C^ie^., Paris, 5 rue de Mézières). For these summaries the reader is referred to that bibliography.

Titles of meteorological publications are omitted, since they are contributed to the Annales by Mr. R. De C. Ward.

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* The writer is indebted to Professor W. M. Davis, of Harvard University, for the use of many writings included in this bibliography; to many geographers for reprints of their writings; and to officers of the departments of the national government engaged in geographical work for information regarding the publications of their departments.

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